Engineering Record

A Weekly Journal Devoted to Civil Engineering and Contracting

Published by McGraw Publishing Company Inc.

Volume 74 NEW YORK, SATURDAY, DECEMBER 9, 1916 Number 24

A Report That Registered

SOME caustic things are being printed in the Chicago papers about a college professor's report on paving conditions. When an engineer with two trained eyes—trained as Prof. Ira O. Baker's have been for more than forty years—sees skimped pavements and broken specifications, his clear, concise, logical presentation of his observations is likely to make the impression intended. Lest the impression be given that Professor Baker's report, the recommendations of which are printed elsewhere in this issue, was simply the result of his three-day automobile trip around Chicago, it should be emphasized that what he portrays is the result of an exhaustive investigation, covering several months, by the technical staff of the finance committee, which is in reality the old efficiency division of the Civil Service Commission, with F. H. Cenfield as the staff engineer and James Miles as chief. Professor Baker is not given to taking anything for granted, so he checked up the work of the staff by personal examination, which convinced him of the "discrimination and trustworthiness of the observations of the staff." The whole report is illuminating reading for the citizen of Chicago as well as for paving engineers in other municipalities.

Thought Stimulants

"SOME of you probably thought that the last lecture, on 'Synthetic Resins,' would be a dry, technical, chemical paper. You may be interested to know that the attendance was 246, that the speaker made his subject intensely interesting to everyone present and that every man there must have gone home with a new realization of how closely scientific research and engineering are related and how interdependent they are. You cannot tell when a meeting may give you something you really need. The talks are purposely on widely different subjects to be as broadening as possible. More likely than not the paper you think may not interest you will be the one you should not have, on any account, missed."

These words taken from the bulletin of the Detroit Engineering Society bring home a truth that thoughtful men must frequently realize. Collateral subjects, even subjects entirely foreign to one's principal pursuit, often are thought-provoking. They shed light from different angles on our own specialty. Experiences in one line, having little direct relation to our own work, are seen to be applicable to our task. Principles that have been discovered in one field may be the touchstone that will convert our own failures into successes, that will point the way to a solution of a hitherto baffling problem. The Detroit Engineering Society is well advised in diversifying its program. Its members may thereby get little information that they can apply directly in their every-day work, but they will gain instead that which is far more important—a broad vision and a contact with the world at large.

If the Job Were Done Over

FAR TOO FEW are the confessions of engineers, in print at least, that if they had it to do over again they would build this or that differently. All the more commendable, therefore, is that paragraph headed "If the Job Were Done Over Again," in the article by Mr. Rands (page 700) on the Oregon City pipe line. Here Mr. Rands tells frankly wherein the plans would be changed if they could be—and by so doing he has perhaps saved other engineers from the same pitfalls. And these confessions do not condemn his work in any measure. Before laymen it may be best to be guarded in admissions that there was a chance for improvement, lest they be misconstrued as acknowledgment of incompetence. But we as engineers know that we must do pioneering, and that there is no stigma attached to failure to find the shortest and best route the first time. Any worth-while advance in the art must be worked out by a series of modifications of the first idea. There should be more engineers willing, like Mr. Rands, to tell the profession what better ways have been indicated by the experiences with their installations.

The Rejected First Plans

ALONG with more confessions of how the completed job could have been improved, the engineering profession could profit by more analyses of adopted plans, particularly of general plans of large projects. Frequently we read that the adopted plan was one of perhaps five considered. Occasionally we are allowed to know in a general way what was contemplated in the other four, and why the fifth was selected. More often we are not. Seldom are we given the benefit of a thorough analysis of all five. Yet if the first four were given extended engineering study are there not lessons to be learned from them? Might they not embody features that for another project, with different governing conditions, would be preferable to the corresponding details in the adopted plan? The Engineering Record is not putting forth a new idea in suggesting that there be more analyses of this sort published; but it desires to emphasize again the proneness of discussions of engineering structures to confine themselves to the designs and construction methods used, to the neglect of the efforts and problems of those who labored with the now despised forerunners of the adopted plans.

Trite but Still True

NEARLY every week brings an editorial wail from some newspaper about a deadly grade crossing and the greed of the soulless railroad in continuing it. Seldom, however, is there the slightest suggestion that the public should contribute to the expense of removing the danger. None of the more enlightened railroad managers will defend the grade crossing as a permanent institution. But they contend, as the Engineering Record has persistently contended, that grade crossings are joint affairs, that they were fully justified when the railroads were built, that the elimination of them now is costing and will cost a vast sum of money and that the public should in all fairness assume a share of the financial burden. The Engineering Record has pointed out how under the rational percentage basis of the New York law a comparatively satisfactory program of grade separation is being carried out, in spite of defects in the law and mistakes in its administration. Until the public and the press in less enlightened—less enlightened in this respect—sections of the country recognize their moral obligations in the matter of grade crossings they need not expect the railroads to do other than fight each grade-separation project to the last ditch.

Civil Engineers' Conventions

SOME TIME AGO it was proposed that the annual conventions of the American Society of Civil Engineers move from one district to the other according to a permanent schedule. Such a schedule having been reported to the board of direction at its meeting on Oct. 10, it was approved and the conventions are therefore set by districts up to and including the year 1928. Presumably, if the society is not redistricted by that time, the same schedule will prevail for another cycle. Incidental to the adoption of this routing for the annual conventions, the board considered the advisability of holding a second meeting annually outside of New York City. It will be remembered that such a second meeting has been frequently advocated and that one of that type, at New Orleans, proved to be very successful. The board is of the opinion that if such a meeting be given a distinctly technical character, the plan could be carried out without having a prejudicial effect on the attendance at other meetings. Moreover, if the preparation of a social program were not regarded as obligatory, no additional burden would be placed on the membership of the district. The board, therefore, adopted a schedule for this second meeting each year outside of New York City, leaving it optional with the designated district, however, to say whether this second meeting should be held. The board has taken an excellent step. It seems hardly likely that the districts will fail to avail themselves of the privilege of having within their boundaries such a second meeting, particularly when it is distinctly stated that the meeting is to be of a technical character and that the districts are not to consider the arrangement of a social program obligatory. One of the great needs of the society has been a closer contact between the members. Such contact would be promoted by the additional general meeting every year. New Orleans has already demonstrated that such a meeting can be carried through successfully. With the board's plain endorsement of the plan, it is hoped that the districts will do their part toward knitting the organization more closely together.

Definiteness in Specifications

THE fundamental qualifications of a good set of specifications were well stated by R. Fleming, of the American Bridge Company, in his article reviewing one thousand steel specifications in the issue of June 24, page 838, when he said that "a specification should be clear, consistent, complete and fair. Explanations of its meaning should not be necessary." In the article on page 708 of this issue Mr. Fleming presents specifications for steelwork of buildings which admirably illustrate the type of specification which he earlier described.

It was suggested in the editorial commenting on Mr. Fleming's previous article that the American Society of Civil Engineers, through a committee, should prepare an authoritative set of standard specifications for the steelwork of buildings. Mr. Fleming's proposed specifications would well serve as a basis for the work. There would probably be disagreement on certain clauses covering most questions. For example, the relatively high limit for the allowable slenderness ratio l/r might be questioned, and there would undoubtedly be debate over the clause allowing part of the area of a column to be disregarded in the computation of the radius of gyration, provided the area is considered not to carry load. This virtually amounts to an increase in the permissible length ratio.

Other vital points in which Mr. Fleming has endeavored to make general practice and the proposed specifications agree are found in the provisions for allowable stresses for countersunk and flattened rivets and the exception of webs of rolled sections from the ¼-in. minimum thickness clause. One noteworthy requirement is found, forbidding the use of rivets in tension, turned bolts being specified for all such cases. If this means that all brackets on the face of columns where some rivets are in tension must be bolted, there may well be raised the old question of the actual strength of rivets subjected to combined tension and shear. Indeed, it is hoped that this will be made the subject of extensive investigation. It is one of the weakest points in our knowledge of the behavior of structural frames, and a really comprehensive series of tests of riveted joints, in which the rivets are subjected to combined shearing and tensile stress, is needed.

Many other details are definitely fixed by Mr. Fleming's specifications. It is hoped that structural engineers will freely discuss them, to the end that our ideas may be crystallized on the general standards that make for safe, rapid and economical construction.

Technical Societies and Advertising

THE American Society of Mechanical Engineers has recently asked its members to express their attitude toward the publication of the book known as *Condensed Catalogs.* The volume is nothing more than a collection of advertisements and has as its sole reason for existence the revenue that results to the society. In other words, the American Society of Mechanical Engineers has gone into a commercial venture.

Originally *Condensed Catalogs* was an offshoot of the advertising carried in the *Journal.* Possibly it might have been called a sop, for it was used to get more advertising into the *Journal* by offering free space in the collection of advertisements in the catalog book. Now all pretense of a relationship between the two publications has been dropped.

The criticism that applies to the publication by the society of *Condensed Catalogs* applies also to the advertising carried in the *Journal,* though the catalog publication is the more flagrant case because of its absolute separation from the engineering papers of the society. The advertising in both publications, however, is a commercial activity and is as much out of harmony with the spirit that should actuate a great society as would be the selling of mechanical supplies or machine parts.

The excuse given for this activity is the revenue it yields for the support of the society's work. As the Engineering Record reads the latest financial statement of the organization, however, the income from advertising is not (at present at least) needed for the support of the society's work, but is purely a means of augmenting the surplus. The audit of books for the year ended Sept. 30, 1916, shows a revenue from advertising of $51,855.26 and an advertising cost of $26,703.23, leaving a net advertising income of $25,152.03. The statement also shows that income exceeded expenses in the same fiscal year by $24,118.41, which is within $1,000 of the net advertising revenue. Presumably this excess will be thrown into the surplus. The surplus and reserve accounts, by the way, now amount to $74,166.20, exclusive of the $24,118.41 excess income over expenses for the last fiscal year, above noted.

It is patent, then, that whatever excuse there may have been in the past, in the way of financial weakness and the need for revenue from sources other than the members, has now disappeared. Moreover, the advertising revenues have for some years been unnecessary in order that the society might meet its ordinary operating expenses.

The need of revenue is, of course, a poor excuse to plead for this means of raising funds. The end does not justify the means. However, since those who support the commercial activities of the society do so because of the revenue which it brings, the passing of the condition they desired to meet should be cited against them in their advocacy of a continuance of the practice. In any event, it was an unfortunate move. The engineering profession as a whole, we believe, will commend the society when it ceases its advertising activities.

The Fruits of Uncertainty

SIX weeks ago, when it was announced that Alfred Craven would retire on Nov. 1 as chief engineer of the Public Service Commission of the First District, New York, the Engineering Record asked editorially, "Does the commission intend to appoint to this post the man who is the logical candidate for it? If not, why not?"

To these questions, the commission has made no adequate answer, though one of its members has protested to this journal that the logical candidate was not passed over, but was given due consideration for the post before his subordinate was promoted over his head and made acting chief engineer. This commissioner believed that Mr. Ridgway's construction experience made him invaluable in his present position.

Meanwhile the uncertainty due to the failure to fill Mr. Craven's position by a permanent appointment is demoralizing the ranks. Competent men, in doubt as to the future, are speculating as to employment elsewhere instead of concentrating on their work.

One hears of this designer who is seeking a new position, of that section engineer who expects to be let out. The reorganization of one of the divisions has substantiated to some extent these rumors. Meanwhile contractors are growing impatient when their work is held up because of delays on the part of the commission's engineering staff in giving them lines and grades. Much of the work is reaching the final estimate stage. If there is to be any wholesale shake-up in the organization the important task of making up the final estimates will be placed in the hands of new men, instead of old employees.

Will not the commission hasten to explain its intentions? If it does not, and sees fit to postpone still longer the appointment of a permanent successor to Mr. Craven, the city's very important subway work is bound to suffer. Already certain newspapers are criticising the delay in the work. The present indefinite status certainly cannot help to rectify conditions. The best interests of the city of New York and of the engineering department of the Public Service Commission demand that the present uncertainty be quickly removed.

Engineers' Salaries and the High Cost of Living

INCREASES of wages are now of regular occurrence. The high cost of living has made an impression on employers throughout the country, and there is a widespread response, in industries which can stand additional wages, to the demand put on the purses of the employees.

As always in an era of high prices, the employers and the wage earners, generally speaking, are able to protect themselves. The one by increasing the price of his product is not only able to keep his margin of profit unimpaired, but is able, at the same time, to increase the compensation of those on a wage basis. We do not mean that the pay increases are always voluntary. They usually are granted because labor is organized or because it will flow to those establishments paying higher rates.

The increases, however, seldom apply to the salaried man. He is not organized. He does not readily shift from company to company. Consequently, there is no pressure upon those who hold the purse strings to take care of him. The engineer, by and large, comes in the salaried class and generally proves a sufferer under these conditions.

Realizing their condition, the engineering employees of the City of Chicago have just addressed to the Mayor and the City Council a dignified petition for salary increases. The document presents briefly the arguments for the increase. It sets forth that the present salaries were established in 1910 and that they are not materially different from that prevailing between 1897 and 1910. The compensation of the employees in the city's engineering service, therefore, has practically remained stationary for 20 years. In the meantime the cost of the necessities of life has increased approximately 50 per cent. The petition well says, "It is self-evident that if the salaries fixed in 1910 were fair at that time, they cannot be considered just compensation under present conditions."

But the employees advance a further argument, and that argument is based on the very solid ground that large increases have been granted the skilled and the common labor employed by the city. The average compensation of common labor has increased 220 per cent since 1897, of skilled labor 83 per cent and of foremen, 51½ per cent. When the actual figures are examined, the astonishing fact is brought out that the average salary in the lowest engineering grade is actually equal only to the *minimum* compensation of common labor. The average salary in the second engineering grade is equaled by the *minimum* wages of skilled labor, while the average foreman receives only slightly less than the average employee in the maximum engineering grade. In consequence, engineers in charge of work and responsible for its proper execution are frequently paid less than the foreman, and even less than some of the mechanics working under their direction. This naturally does not make for efficiency. Competent engineers will constantly seek to leave the service, while workmen, conscious that their superiors receive a lower compensation, are less amenable to the authority of those over them.

If the Mayor and City Council of Chicago will look at the subject from these two angles alone, we believe that they will agree to very substantial increases in the compensation of the city's engineering employees.

But there is a third reason, touched on also in the petition, which we believe deserves the very strongest emphasis. The engineering employees of the City of Chicago almost without exception do not do purely individualistic work. Whatever is intrusted to them goes far beyond the particular activities of the man in question. The designing engineer lays out structures whose cost runs into the thousands, and even into the hundreds of thousands, of dollars. The superintendent of construction works not by himself, but directs large expenditures in labor and in materials. Manifestly, men in these capacities must have superior judgment, must carry responsibilities far exceeding those of the average type of city employee. If the Chicago city officials will assent to the principle that men should be paid in accordance with the responsibility imposed upon them, there will be little further need for argument by the engineering employees of the city.

The petition is a dignified one. It presents only facts. It deserves, and we trust will receive, the careful and favorable consideration of the authorities to whom it is addressed.

Is Uniformity Possible in State Motor-Truck Legislation?

WITH New York State committed to legislation, effective Jan. 1, 1917, governing the weight, size and speed of motor trucks, and with other states, notably Pennsylvania, New Jersey, Maryland, Connecticut and Michigan, contemplating new or revised statutes along similar lines, it is clear that the control of motor-driven traffic on public highways is developing into a problem of more than local significance.

If this view is correct, it is time to consider a plan by which at least some degree of uniformity may be introduced into the forthcoming laws. Highway engineers have before them, as an example, the hodgepodge of road legislation developed by uncoordinated efforts of individual states. Is the same condition of disorder to be repeated in the case of motor-truck laws? Unless an attempt is made to standardize the regulatory measures for motor trucks we will have as many different sets of rules and regulations as there are states in the Union. To users and manufacturers of motor trucks, and to engineers who must build and maintain highways to carry the traffic of the future, this prospect is not encouraging. Motor-truck men have already expressed the fear that they may be legislated out of existence in certain localities.

Motor trucks doing interstate business may soon be governed by two or more independent, and possibly conflicting, sets of state requirements. A contractor with a fleet of trucks and trailers who has just finished a job in New Jersey may have his equipment ruled off the roads in New York State. He would have to purchase trucks and trailers of different design or alter the ones he has to make them conform to New York State requirements. In either case he would be saddled with an expense.

Motor-truck manufacturers are, naturally, opposed to any restrictions of the use of highways. Nevertheless, if such laws are inevitable, it is needless to point out to them the advantages of uniform statutes. Under them, manufacturers would be able to standardize their machines instead of making different types for each state. Uniform laws would result in lower truck production costs and, it is fair to assume, in a correspondingly reduced price to purchasers.

It may be argued that types of road vary in different states, and that in one locality the highways are capable of sustaining heavier loads than in others. This is undoubtedly true, but it is conceivable that a general code would take such factors into account. If merely the framework of a sane and reasonable code of regulations for motor trucks could be constructed, it would save a vast amount of needless work in states contemplating the enactment of such measures.

The general procedure preliminary to the passage of a motor-truck bill is first to appoint a commission to investigate the subject, then hold a number of hearings at which those interested may express their views. Finally, after many changes the regulations go to the legislature in the form of a bill. Why is it necessary to repeat this routine for every state that is to have a motor-truck law? Why cannot the work be done once and for all, in its principal features at least, by a committee representing national highway and motor-truck interests? If it be conceded that motor-truck legislation is coming—and every indication points that way—it is time for such organizations as the American Highway Association, the American Road Builders Association, the Motor Truck Club of America, the National Automobile Chamber of Commerce, the newly formed Association of Trailer Manufacturers, and other bodies, to inquire into the possibilities of co-operation in drafting what might be termed a model motor-truck law.

To be sure there is some degree of co-operation among states at present. New York, for example, has the benefit of the tentative set of rules and regulations proposed for New Jersey. Massachusetts, also, has contributed valuable information, but the co-operation has taken the form rather of finding out what the other states have done than of joining with them in reaching some degree of standardization in regulatory measures. Useful as this practice is, the full benefits will never be secured until efforts are centralized in a committee of national scope representing the builders of highways, the users of highways and the manufacturers of motor trucks and trailers and their accessories.

Bids Asked Before Bonds Were Voted to Show That Estimate Represented Real Cost of Pipe Line

Even Then $25,000 Was Refunded to the Water Department of Oregon City When Job Was Completed—High-Pressure Service Without Pumps or Elevated Tank—Cost $350,000

By H. A. RANDS

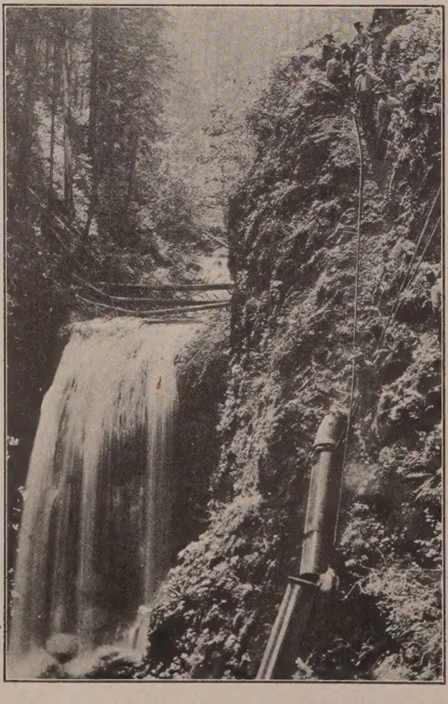
Of Rands & White, Civil and Hydraulic Engineers, Portland, Ore.

ONE OF THE ADVANTAGES afforded many of the cities of the Pacific Northwest is the possibility, through the proximity of the mountains and the protection afforded by the Forest Reserve, to secure an abundance of pure water at a nominal cost. Portland was the first to construct any considerable pipe line when in 1893 it brought in from the Cascade Mountains its now famous Bull Run supply. Seattle, shortly afterward, through a somewhat longer line, secured its supply from the Cedar River. Since then many smaller cities have followed the example of these larger ones. Probably the most notable of the projects undertaken by the smaller cities is that financed by Oregon City, Ore.

SOURCE OF PRESENT SUPPLY

The present source of the Oregon City water supply is the South Fork of the Clackamas River, a clear swift mountain stream having a catchment area of 27 square miles and a low water discharge, taken at the end of the 71-day record dry spell in the summer of 1914, of 13,500,000 gal. in 24 hours. At the intake the elevation is 820 ft., while the head of the stream is 5000 ft. above sea level. Samples of the water taken during the ordinary rainy weather of winter gave counts of 2 per cubic centimeter after 72 hours' incubation. The highest count so far obtained from the intake was near the end of the 71-day dry spell already mentioned, when a count of 25 per cubic centimeter was found.

To meet the arguments of those who contend that a project invariably costs from one and one-half to two times what the engineer estimates, the commission resorted to the rather novel expedient of calling for bids before the bond election. As a result thirteen bids were received, and the contract was tentatively awarded pending the result of the bond election. After the citizens had voted in favor of the project the contract was signed and both the commission and the low bidder lived up to their pre-election agreements.



PIPE LINE SHOWN ON COVER, AT EARLIER STAGE OF CONSTRUCTION

Bids were called for on machine-banded wood pipe, lap-welded steel pipe and riveted steel pipe. After opening the bids there occurred the usual controversy as to the best material. The wood pipe was cheapest. Riveted pipe was more expensive and lap-welded pipe the highest priced. The commission at one time voted to award the contract for riveted pipe. This was done despite the recommendation of the engineers, who contended that to build a line of the character and size of the one in question, having thousands of degrees of curvature, both horizontal and vertical, with inflexible riveted joints to be laid out and cut in advance, would be a long and tedious job. Later the vote was reconsidered and the job was awarded to the same bidder for Matheson pipe construction.

Several conditions affected the price at which the pipe was furnished, with the result that an extremely low figure was obtained. One of these reasons was the great calm which hung over the steel trade during the early months of the European war. Another was the fact that this line was being built almost within earshot of the whistles of the great wood-pipe factories of Oregon and Washington.

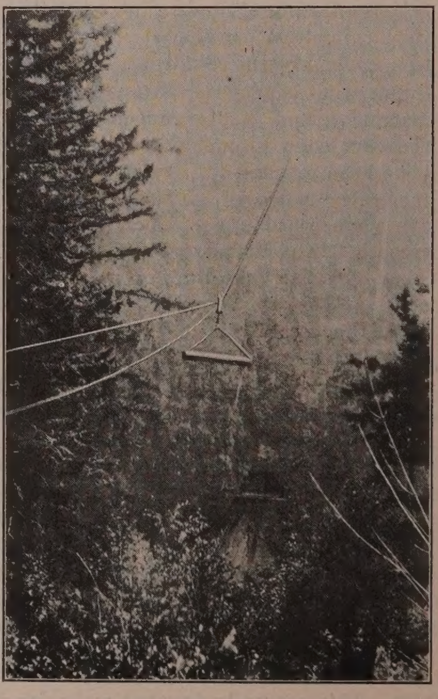
DESCRIPTION OF LINE

The pipe on the upper 13 miles has a diameter of 18 in.; on the lower 11½ miles 16-in. pipe was used. The larger size has a thickness of 0.245 in. and the smaller 0.234 in. The preservative used was the usual dipped coating made by the National Tube Company. For 10 miles from the intake the line follows the gorge of the Clackamas River, where there was much rock work. Several tunnels, having an aggregate length of 1212 ft., were also necessary. Along much of this upper 10 miles the pipe had to be carried across the river from the road on the north bank by means of aerial lines and donkey engines. For this the huge trees were used for cableway towers, and they served the purpose admirably even when the span was as great as 1000 ft. To the credit of the contractor, it may be said that this difficult work was accomplished without a single accident to a workman and with the loss of only one length of pipe.

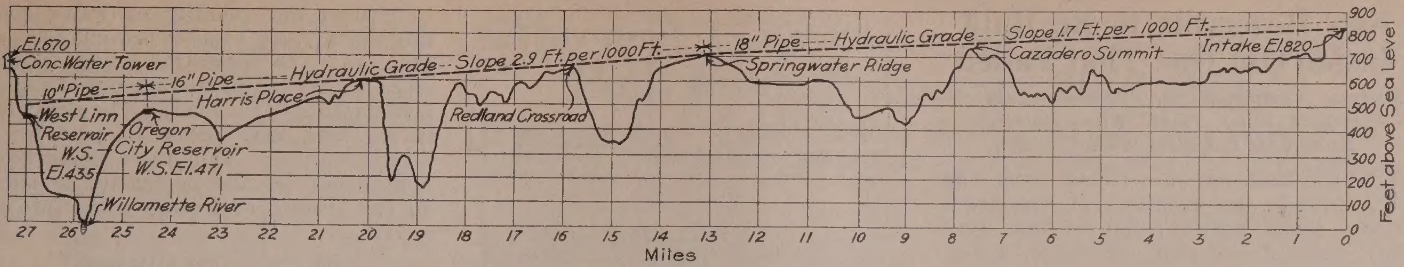
Four-inch blowoff valves are placed in all the principal depressions. These were set in double bell-end castings 13 in. in length, with the blowoff branch tangent to the bottom. In several places in sharp draws these blowoff branches were cast integral with the ells used to make the required vertical curve. To relieve the line of air in filling and to take care of any vacuum in the event of the breaking of the line, vent pipes were placed on the principal summits near the hydraulic grade. On the principal lower summits 2-in. Chabot air and vacuum valves are used for the same purpose. Several of these are twin set, and in one instance three are set in one battery. To relieve the line of any air which may accumulate during operation, a ¾-in. corporation cock is placed on every lesser summit. By carrying a piece of ½-in. pipe 3 ft. long with a ¾-in. reducer on the lower end and an ell and nipple on the upper end to turn the stream to one side, the patrolman is able to open these corporation cocks easily, without getting wet. On a few summits air-relief valves of the lever-and-foot type were also used.

IF THE JOB WERE DONE OVER AGAIN

At the end of every job there are always a few things which, if it was being done over again, would be handled differently. First among them would be the use of the National burlap coating in place of the dipped coating now on the pipe. Another change would be the exclusion of a few elbows used to negotiate sharp summits. Two of these lifted when the line was filled. They were taken out and the profile was revised to eliminate them. Two of the three still in use are anchored in rock; the third is heavily loaded. For negotiating sharp



TREES WERE USED WITH GREAT SUCCESS AS CABLEWAY TOWERS IN MOVING PIPE



PROFILE OF OREGON CITY PIPE LINE, SHOWING LOCATION OF RESERVOIR AND TANK

depressions elbows are desirable; on sharp summits they are likely to give trouble. Another change would be the elimination of several 16-in. gates put in the 18-in. pipe and several 14-in. gates in the 16-in. line. We have never had occasion to close these gates since filling the line, and except for convenience in testing they are of little use. The reason why this is so may be deduced from an examination of the profile.

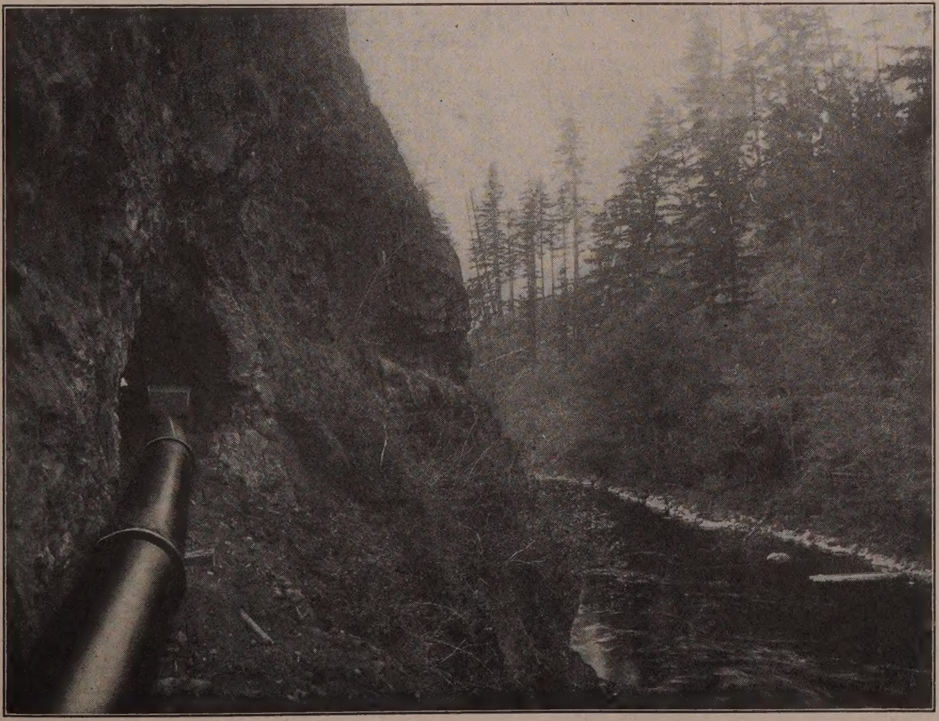
The line as far as Harris Place, where the last gate is located, is made up of four great inverted siphons. Should any of these need repair the others will remain nearly full even when the water is shut off at the intake. In practice, too, it has been found that as much of the line is far below the hydraulic grade it is possible, when making repairs, to keep the water right behind the men by opening one or two blowoffs. When the repairs are completed the blowoff is closed and the water sent on its way.

NO PUMPS OR TANKS USED

Oregon City has a high-pressure zone. Water is supplied to that district without resorting to pumps or to an elevated tank. By reference to the profile it will be seen that from the Springwater ridge to Harris Place the hydraulic grade has a drop of 2.9 ft. in 1000. From Harris Place west to the reservoir the drop amounts to 5.5 ft. in 1000. Instead of reducing the diameter of the pipe, and losing the head in friction, the 16-in. tube was continued to the reservoir, at the entrance to which was placed a regulating gate. By partly closing this gate the head on the high-pressure side is raised to the hydraulic gradient for a 16-in. pipe. This gives the high-pressure zone a minimum pressure of about 37 lb. To prevent subjecting the line to the full hydrostatic head (in the event of an inadvertent closing of the regulating gate), a concrete overflow basin with waste pipe has been placed in the line at Harris Place. The following paragraph explains how this holding up of the hydraulic grade makes it possible to serve the high-service zone in West Linn.

WEST LINN SYSTEM

By the terms of an agreement entered into before the construction of the line was begun, West Linn, located directly across the Wilamette River from Oregon City, had purchased a one-third interest in the water-supply system. As that city had no distributing system, plans were prepared and a contract was let soon after work was begun on the main line. The West Linn distributing system was built by the same firm that had the contract for the larger job. Matheson double-wrapped National coated pipe of 4, 6, 8 and 10-in. sizes were used. West Linn, like Oregon City, has a high-pressure service zone. To supply it, the 2,500,000-gal. reservoir included in the system was so located that the water in discharging into it from the pipe line would turn a Pelton wheel geared to a triplex pump. This lifts the water for the high-service zone through a 1700-ft. pipe line to a reinforced concrete water tower 50 ft. high and of 14-ft. internal diameter, located on the highest point.



ABOUT 1200 FEET OF TUNNEL WAS NECESSARY IN THE FIRST 10 MILES FROM THE INTAKE

Actual construction was started April 12, 1915. The first water reached the reservoir Oct. 7 of the same year. Notwithstanding the fact that the bonds sold at $95.56, after all right-of-way, engineering and other charges were paid, $25,500 of the original bond issue was turned back to the water department. The rated capacity of the line is 3,000,000 gal. in 24 hours, although no capacity tests have been made. The entire distributing system cost about $65,000 and was completed in December, 1915.

The principal quantities, with unit and total prices, are given in the accompanying table.

COST OF OREGON CITY PIPE LINE

Item	Quantity	Unit price	Total price
Clearing right-of-way	43.54 acres	$200.00	$8,708.00
Solid rock (in trench)	4,380 cu. yd.	4.50	19,710.00
Solid rock (side cut)...	1,324 cu. yd.	1.50	1,986.00
Loose rock....	13,604 cu. yd.	1.00	13,604.00
Cement gravel.	5,392 cu. yd.	.75	4,044.00
Common gravel.	38,364 cu. yd.	.40	15,345.00
Tunnels (4 x 6 ft.).......	1,212 ft.	6.50	7,878.00
Matheson pipe:			
18-in. f. o. b. job	69,940 ft.	1.37½	96,167.50
16-in. f. o. b. job	61,797.5 ft.	1.17	72,303.10
18-in. distributing and laying ...	68,680 ft.	.40½	27,815.40
16-in. distributing and laying ...	60,680 ft.	.31	18,848.00
Cast-iron specials	21,810 lb.	.07	1,526.70
Miscellaneous			4,870.18
Extra work			3,115.53
Total			$295,921.41

PERSONNEL

D. C. Henny and J. L. Stannard of Portland were consulted on the work. S. A. Cobb of Oregon City was the engineer for the West Linn system, the reinforced-concrete standpipe for which was designed by W. G. Kirchoffer of Madison, Wis. The Oregon Engineering & Construction Company, of Oregon City, had both contracts, and the writer was engineer for the main pipe line and consulting engineer for West Linn.

To Decolorize Tar Streaks in Concrete Road Crack Repairs

Studies are being made, according to the latest annual report of the Board of Wayne County (Mich.) Road Commissioners, to develop a preparation which will accomplish, in the repair of concrete road cracks, what Tarvia mixtures accomplish, yet which will have a color so nearly like that of concrete that repaired spots will not be noticeable. Present methods of repairing cracks necessarily draw attention to the location of the cracks because of the black streak left by the tar after the required maintenance work has been performed. This objection, according to the Wayne County report, does not come from road users or property owners, but from engineers, road builders, and salesmen.

New Reservoir to Be Built Inside Old One That Failed

Designs Completed for Reconstruction at Cleveland Filter Plant, Where Concrete Basin Roof Collapsed When Finished

UTILIZING as an outside form the filtered-water reservoir at Cleveland, Ohio, which partly collapsed last July just when it had been completed, a new reinforced-concrete basin will be built within the old one in accordance with designs upon which bids for construction were received this week. The work will involve about 14,000 cu. yd. of concrete, 760 tons of steel reinforcement and 10,000 cu. yd. of backfill.

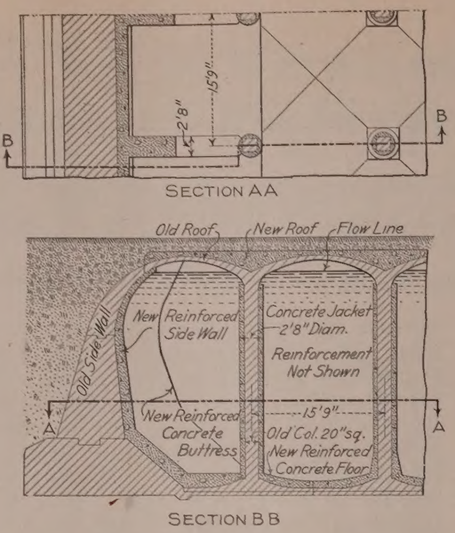
While this summer's accident, which was described in the Engineering Record of July 29, page 151, involved the failure of only four columns of the existing structure, together with the section of the groined arch vaulting which they supported, extensive investigations of the quality of the concrete in the remainder of the reservoir cast suspicion upon the entire structure and led to the conclusion that it was unfit for use. The alternatives therefore were (1) to demolish the damaged basin and replace it with a new one on the same site; (2) to choose a new site and build a new structure; (3) to construct a new reservoir inside of the old one. In the first case the cost of demolition would have been excessive and, in the second, no other site was available for the new structure. These considerations therefore led to the adoption of the third scheme, a new basin inside of the old one, as the most economical and practical one.

OLD WALLS AS FORMS

The original filtered-water reservoir has over-all dimensions of about 936 x 195 ft. and is about 28 ft. deep from floor to roof inside. It is separated into two sections by a concrete division wall. In the designs for the reconstruction, which were prepared by Nathan C. Johnson and Frederic C. Noble, both of New York City, acting as consulting engineers to the city of Cleveland, no reliance whatever was placed on the strength of the existing basin. The walls were considered merely as convenient outside forms against which the new concrete could be poured, while the columns were regarded as so much sand—material which, the designers point out, can be depended upon to carry loads if adequately confined. The repair scheme for the columns therefore involved the jacketing of those now standing with spiral steel reinforcement and enveloping the whole with a cylinder of concrete. The new column jacketing is carried up to the groined arch vaulting and extends above the old column heads. The original columns were square, measuring 1 ft. 8 in. on a side, while the jacket will convert them into cylinders 2 ft. 8 in. in diameter, except at the base, which will flare out to a diameter of 3 ft. 8 in.

BUTTRESSES AT SIDE WALLS

The accompanying drawings, in which the reinforcement details are largely omitted, show the main features of the new work. The new side walls are reinforced in both directions and act as slabs supported by reinforced-concrete buttresses at 15-ft. 9-in. intervals (the spacing of columns center to center). These buttresses serve also to tie the flooring and roof together. Acting as beams, they transmit pressure on the side walls—either internal, due to a head of water, or external, due to earth pressure—to the roof and floor, which are both heavily reinforced. Thus, the type of construction resolves itself into a huge reinforced-concrete box, to be built within the present basin by piercing holes in the vaulting of the latter for the introduction of the new construction materials.



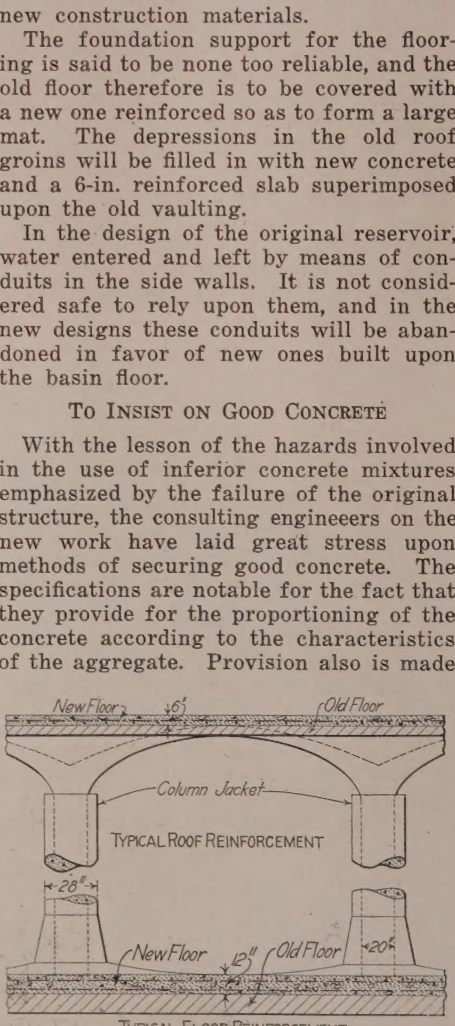
THE OLD RESERVOIR WILL SERVE MERELY AS A FORM AGAINST WHICH TO PLACE THE NEW CONCRETE—OLD COLUMNS WILL BE JACKETED

The foundation support for the flooring is said to be none too reliable, and the old floor therefore is to be covered with a new one reinforced so as to form a large mat. The depressions in the old roof groins will be filled in with new concrete and a 6-in. reinforced slab superimposed upon the old vaulting.

In the design of the original reservoir, water entered and left by means of conduits in the side walls. It is not considered safe to rely upon them, and in the new designs these conduits will be abandoned in favor of new ones built upon the basin floor.

TO INSIST ON GOOD CONCRETE

With the lesson of the hazards involved in the use of inferior concrete mixtures emphasized by the failure of the original structure, the consulting engineeers on the new work have laid great stress upon methods of securing good concrete. The specifications are notable for the fact that they provide for the proportioning of the concrete according to the characteristics of the aggregate. Provision also is made to control the quantity of water going into the mixture, so as to prevent over-wet concrete. The consulting engineers took steps to have the proper amount of cement introduced into the mixtures by providing, in the bids, that cement be paid for as a separate item. Thus there would be no inducement for the contractor to skimp on the amount of cement going into his mixers.



TYPICAL REINFORCEMENT OF NEW FLOOR ON TOP OF OLD AND NEW REINFORCED ROOF

TO TEST OLD CONCRETE

An aftermath of the failure of last July is an extensive investigation of the quality of concrete in the old filtered-water reservoir, supplementing examinations already made. This investigation, which is being conducted by Nathan C. Johnson, consulting engineer, of New York, involves the taking of about 2 miles of 6-in. cores from the old concrete to serve as a basis for a thorough study of its quality. The cores, taken by means of a shot drill, are to be used to verify the conclusions of the examining engineers.

Avers Chicago Can Improve Its Paving Methods

Professor Ira O. Baker Recommends Better Specifications and Inspections—Suggests School for Inspectors

ASIDE from the sensational charges of skimping on materials, depths of foundations and inefficient inspection in the paving of Chicago streets by the Board of Local Improvements, Prof. Ira O. Baker in his report to the finance committee of the city council makes several recommendations that are applicable to many other cities. These recommendations were written following (1) a three-day inspection of paving and asphalt plants, (2) a study of current specifications, (3) a half-day discussion with the chief engineer, and (4) an examination of an analysis made by the staff of the finance committee.

TO IMPROVE SPECIFICATIONS

As to specifications, Professor Baker suggests that they be changed so as to secure clear language, logical arrangement and good typographical form. Unless these conditions are fulfilled the specifications do not make the intended impression on either the contractor or inspector. They should have no deadwood—only those requirements which it is intended to enforce. The requirements should be definite enough to secure good work. It should be seen that the clauses governing the business relations of the parties are clear and defined, and that they properly safeguard the interested parties. Particular attention should be paid to the technical clauses, to the end that the resulting work may be in accordance with the best state of the art. Too dry concrete and few real expansion joints were found in curb and gutters. Concrete base for asphalt was found left sleek instead of rough, and the thickness was skimped to an estimated extent of $200,000 on the season's work.

ESTABLISH INSPECTORS' SCHOOL

To improve the inspection, which he found lax in many cases, he makes the following suggestions: Prepare clear and comprehensive instructions to the inspectors. Establish a school for the instruction of inspectors to teach them the technical points necessary for the discharge of their duties. Establish a system of checks and inspection to determine whether the inspectors are doing their duty and are observing the requirements of the specifications. It would probably be wise, he said, to provide the inspection engineers with automobiles in order that they may appear at unexpected times in widely different parts of their territory. Provide some system of penalties for lax inspection.

WHAT SHALL BE FUTURE POLICY?

As to the future policy to be settled, the following questions were asked: Should the Board of Local Improvements buy hydraulic cement and furnish it to the contractor? Is it wise to reduce the number of brands of asphalt that may be used? Should the board buy asphalt and furnish it to the contractor? Should the contractors' guarantee be eliminated? Should not cement filler be substituted for the pitch filler now used in brick pavements, and also in granite block pavements?

The advisability, Professor Baker said, of having the inspector present during the preparation of the subgrade should be considered. Closer co-ordination should be established between the Board of Local Improvements and the Bureau of Streets in the Department of Public Works. The Bureau of Streets might otherwise continue to repair streets when it is cheaper to lay a new one. Closer co-operation would also give to the Board of Local Improvements a knowledge of the cost of maintaining and cleaning which would be of inestimable value in determining the relative economy of the different forms of construction.

KEEP INSPECTORS BUSY ALL YEAR

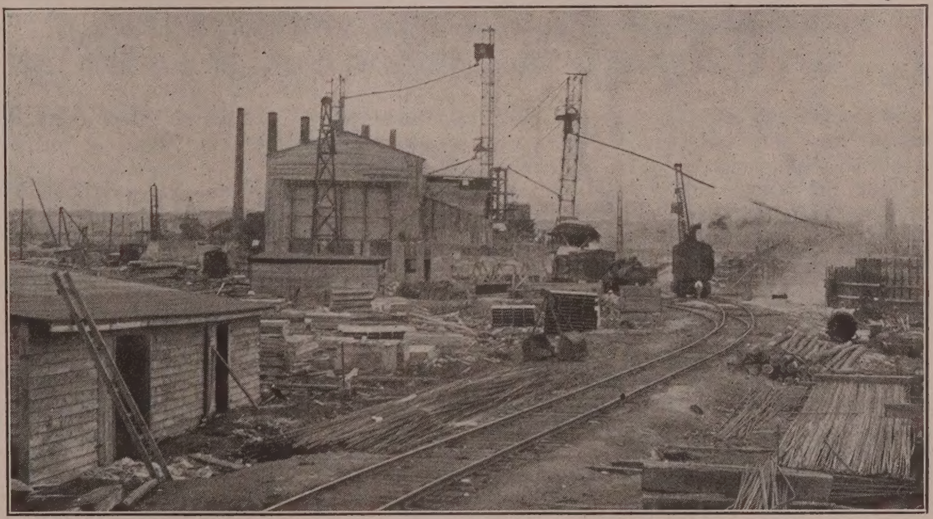
Investigations by the board's corps of inspectors during the period when construction is not in progress is one of the constructive recommendations. So much work, 150 to 200 miles per year, is done that any small improvement would result in a greater saving than the cost of the investigation. It is suggested that the following matters are proper subjects: The proper proportions in concrete; tests of sand in concrete (cement is now tested, but the variation in strength due to the sand may be sixteen times as great as the variation in the cement); elaboration of field tests; census of travel to determine proper types of pavement to use on certain streets; a thorough study of the cost of maintenance and of cleaning of different types of pavements under traffic of different amounts and character. Of prime importance, he thinks, is the effect of motor traffic on street pavements, and the board should know whether certain types of pavements will be adequate to meet such motor traffic as is likely to come on the through-traffic streets in the future.

With reference to the personnel of the inspectors, the report indicates that out of 114 inspectors employed, 66 were civil-service men and 48 were appointed on temporary authority. Professor Baker is of the opinion that all these men should be technically trained, but the records indicate that they are from all walks of life. He would reorganize the department so that these inspectors could work up through and become division engineers. He would abolish the position of general inspector and substitute that of junior engineer with technical training.

Byproduct Coke Ovens on Jersey Meadows Built Inside Temporary Steel Sheds

Large Quantity of Materials Handled Over Soft Ground—Work Developed So as to Keep Two Concrete Plants Busy—75-Foot Tower Mounted on Flat Car

ON GROUND so soft that it is difficult to maintain construction tracks, a two-and-a-half-million-dollar byproduct coke plant is being built at a rapid rate on the meadows west of the Hackensack River and north of the Lackawanna Railroad. Begun May 1, this plant is expected to produce coke early in 1917. About 20,000 round piles 45 to 70 ft. long are required to support the various structures, and the 110 coke ovens will contain approximately 320,000 cu. ft. of brick work. The construction work has been planned so that concrete materials were received by water and piling and other construction materials by rail, so that most of the concrete work could be carried on without interfering with the distribution of piles, brick and other materials over the construction tracks. Steel concrete towers 75 ft. high have been mounted on flat cars and moved, without accident, over soft track. For the construction of the ovens themselves silica brick, which are easily injured by the weather, are used and steel-frame sheds the size of mill buildings are employed to inclose the two batteries of ovens during construction.



LOOKING TOWARD RIVER—COKE OVENS IN CENTER, BYPRODUCT BUILDING AT RIGHT

Construction siding shown makes loop around far end of ovens, returning on left side. It is used to deliver all materials except concrete aggregate, which is received by water at point marked by pile driver to the left of locomotive crane.

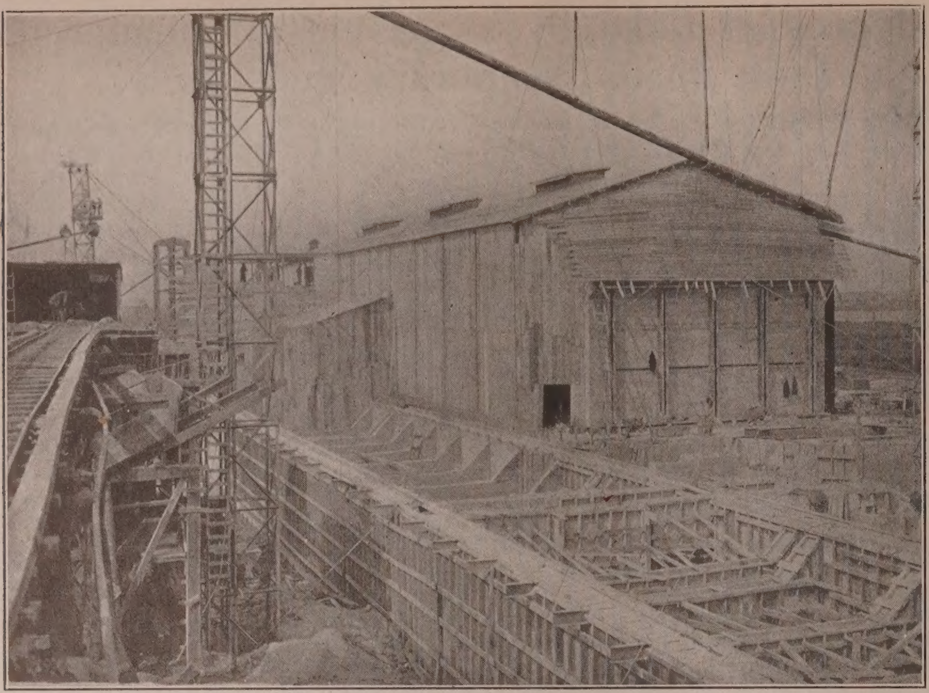
COKE PRODUCTION FIRST CONSIDERATION

The first consideration governing the planning of the construction work was the production of coke at the earliest possible date. The entire plant is founded on piles in the soft mud underlying the meadows, and it is planned to fill in the entire site with 10 or 12 ft. of cinders. Therefore very heavy cellular concrete footings surmounting the piles were required to bring the floor level of the structure up to the proper grade. The concrete below final ground level under the brick ovens alone amounts to 15,000 yd., and 8000 yd. is required under the byproduct building. This building, the second largest piece of construction, was the second undertaken, and the third unit on which work was begun was the boiler house, requiring about 5000 yd. of concrete. The quenching track, purifiers and coal and coke handling apparatus were undertaken next, and the benzol plant, which is not essential to the early operation of the plant, will be constructed last.

The pile driving proceeds very rapidly, the majority of the 20,000 piles required having been placed by five drivers this summer. The rigs are operated by drop hammers, with which quite as rapid driving can be done in the soft mud as with steam hammers. The drivers were handled on skids over the meadow, and on this account the piles had to be driven before any excavation could be made. It was at first thought that cofferdamming would be required for the footing excavations around the top of the piles to exclude water and prevent caving of the soil. The mud, however, filled with grass roots at the surface, proved almost impervious and stood with a vertical face. No trouble was experienced in excavating the 4 or 5 ft. required and in cutting off the piles, and very little pumping was necessary. The dirt was disposed of by dumping it near the sides of the excavations, where it will become part of the permanent filling of the site.

TRACKS LAID ON SOFT GROUND

At the beginning of the work a siding was laid out on the north side of the Lackawanna Railroad, which passes through a material and storage yard to the site of the plant, where it forks, one branch going to the north side of the ovens and the other passing between the south side of the ovens and the byproducts building and power plant. Three or 4 ft. of cinders brought in over the railroad had to be dumped along this entire line before anything like a solid foundation could be secured for the track. The brick have been stored near the buildings for which they are required, so that rehandling them by rail is not necessary. The piling has generally been distributed to the drivers in the cars in which it was received. The structural steel, however, together with the tanks, piping and such



STEEL-FRAME SHEDS 40 FEET HIGH SHELTER BRICK OVENS DURING CONSTRUCTION

Main concrete plant at left, track foundation for machine that unloads ovens in foreground. Shed covers west battery of ovens, the other battery being to right of view, with foundation for coal bins shown between.

of the mechanical equipment as has been received, has been unloaded in the yard and will be rehandled to place on work cars. One 55-ton locomotive and two dinkeys take care of the switching, except for that necessary to supply the track mixing plant with aggregate, which is done by one of the locomotive cranes.

MAIN MIXING PLANT SUPPLIED BY WATER

A stationary tower at the foot of which is the main mixing plant was erected near the middle of the south side of the foundation for the ovens. Opposite it on the north side of the ovens was located a tail tower. The plant at the foot of the first tower consisted of a ¾-yd. mixer erected under material bins which were supplied by cars running on an overhead trestle to the material dock on the Hackensack River. These cars could also be tripped to unload at any point along the trestle, the space underneath which was reserved for storage. The cars were loaded from a hopper located over the track at the dock, this hopper being fed by derrick direct from the barges. The material in the storage piles is rehandled by being loaded into gondola cars with one of the cranes and from these cars conveyed to the desired point in the same way.

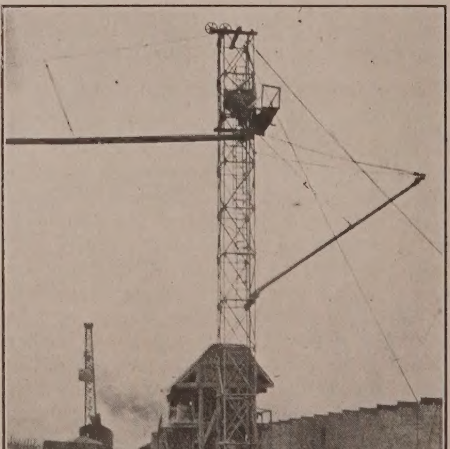
This plant was used to concrete the cellular foundation for the ovens and also that for the boiler house and purifiers. When the latter is completed, it will be taken down and mounted on a flat car.

75-FOOT TOWER MOUNTED ON FLAT CAR

The track plant, which is used to concrete the foundation for the byproduct building, consists of a 75-ft. steel tower mounted on a standard flat car. The tower extends nearly to the track, and is hung in front of the car. On the car over the mixer are small bins, which are supplied by a locomotive crane. A cement car is coupled behind the mixer car in use, and a belt conveyor hung at the side of the latter is used to transfer cement from the door of the box car to the charging platform. This conveyor, made on the job, consists of two chains between the links of which are fastened crosswise narrow pieces of plank about 2 ft. long. The chains run over sprockets, and the belt is driven by a small motor at the end nearest the mixer.

The tower is of course guyed when in use. The rig has been moved successfully a number of times, however, without the use of any guys, by emptying the bins and lashing to the tower the boom of the locomotive crane, which does the switching, to keep the tower from swaying. This plant, like the stationary one, is provided with a ¾-yd. mixer. All the concrete equipment is of Lakewood manufacture. The plant mounted on the flat car has made a maximum run of 406 yd. in 12 hours, while the stationary plant has placed 360 yd. in 10 hours.

The forms are of wood, and as the concrete work is all low, the exterior forms are braced directly to the ground. The interior forms are secured with the Universal clamps. The carpenter shop, equipped with power saws, is located, with the machine and blacksmith shops, at the southwest corner of the work. All the equipment is run electrically except the cranes and locomotives. Power is received from the New Jersey Public Service Corporation at 2200 volts alternating current, transformed by a Westinghouse motor-generator set to direct current at 220 volts and distributed over the job in insulated cables laid along the surface of the ground.



TOWER 75 FEET HIGH ON FLAT CAR

STEEL SHEDS FOR BRICKWORK

The silica brick used in building the ovens must be protected from the weather during laying, and for this purpose steel-frame sheds are used. Being 40 x 200 ft. and about 40 ft. high, these sheds are of unusual size for temporary structures. Accommodating in width a standard oven of 12¼ tons capacity, the sheds may be built to any length by joining on additional bays. They were built with the intention of using them repeatedly on successive contracts.

The silica brick are laid in mortar made with hydrated lime. About 120 bricklayers are required in building the ovens and carrying on the brickwork for the other buildings, which are steel frame above the foundation. The erection of this steelwork was begun on Oct. 1.

The plant is being constructed for the Seaboard Byproduct Coke Company by the H. Koppers Company of Pittsburgh, for whom T. S. Fillebrown, erecting engineer, is in charge at the work. The Linde & Griffith Company is contractor for the pile driving, while the steelwork is furnished and erected by the McClintic-Marshall Company.

How to Get Best Results with Tile Drainage

W. C. Curd of Missouri Pacific Gives Conclusions from Experiences of Six Years—Not a Panacea for All Wet Cuts

WHEN and how to use vitrified tile in the drainage of railroad subgrades is discussed by W. C. Curd, drainage engineer of the Missouri Pacific Railway, in a recent *Bulletin* of the American Railway Engineering Association. From 1905 to 1911 tile was applied at 714 locations to remedy water pockets or wet cuts. Eleven per cent were reported as failing to give benefits because the tile was either insufficiently deep or not placed in the proper location. On this account and to determine the value of tile drainage for roadbed an investigation was made. The investigation showed a remarkable benefit, states Mr. Curd, where the drains had been properly installed. He estimates a return of from 50 to 200 per cent per year in decreased cost of maintaining line and surface.

His conclusions as to how to secure the greatest permanency and benefit with tile drains are substantially as follows:

LAYING THE DRAINS

Drains should be laid with bell-end vitrified salt-glazed sewer pipe of a minimum diameter of 6 in., with unsealed joints. The top of the tile should be placed 1 ft. below frost line and a minimum distance of 1 ft. below unstable or moving material. The depth in each case should be carefully determined by test holes or by inspecting the excavation.

The tile should be laid to a grade established by level and with all the fall obtain-able. The location of the center line of the tile should be parallel to and from 4 ft. 6 in. to 7 ft. from the center line of the track. The tile should be placed directly on the bottom of the trench. After it is laid to line and grade, and before backfilling, it should be covered with straw, grass or some such material to prevent loose particles in backfilling from entering the joints.

The trenches should be backfilled with cinders, with coarse material placed directly around and over the tile. Where the walls of the trench show signs of distortion from passing loads, a sufficient quantity of riprap or coarse stone should be mixed with the cinders to brace the walls.

LATERALS AND OUTLETS

Pockets under the track should be tapped with cinder-filled lateral trenches, and connected into the tile drain trench, but without connection with the tile drain except through the unsealed joints.

All surface water should be removed from cuts by intercepting and side ditches, otherwise the tile drain may be overtaxed and eventually fail entirely.

After the drains have been installed it is essential to maintain free outlets to prevent water backing into the tile. The ends of the drains should be surrounded and supported by concrete or dry masonry to guard against underwash. To prevent small animals from entering the tile the outlet should be protected by rods or grating.

CAUSES OF FAILURE

Failures of drains come from the following causes: Insufficient depth below moving material; shifting grade or alignment, causing joints to open; insufficient grade to provide proper flow; location of drain in impervious material without providing adequate means for tapping saturated material with lateral drains or cross-trenches, or distortion of walls of trenches.

Tile drainage, concludes Mr. Curd, is not a panacea for all wet cuts and its use is not recommended without a complete knowledge of the conditions to be corrected. When these are known and proper methods of installation are applied, much benefit is reasonably sure to follow.

Scarcity of Pebbles Forces Concrete-Road Change

Owing to inability to secure sufficient quantities of pebbles up to the quality of its specifications, the Board of County Road Commissioners of Wayne County, Michigan, according to its annual report for 1915-16, has been forced to revert to the former two-course specifications, using either pebbles or a local stone for the base and traprock or Wisconsin granite for the wearing surface. In building a two-course road the Wayne County method has been to make the lower course of a 1:2:4 mix, with a 3-in. traprock or granite wearing surface of a 1:1½:2½ mix. As traprock and granite cost about $1.35 a ton more than pebbles, and as there is an extra labor charge in handling two-course work, the Wayne County engineers report an additional factor in rising costs. It is believed, however, that over a long period of time the increased quality of the work due to the better quality of the wearing surface through using a harder, tougher and more uniform stone will offset the increased cost of the road by adding materially to its life and usefulness.

Settlers with Small Farms Most Successful on United States Reclamation Projects

Secretary Lane Gives Increases in Areas Irrigated, Value of Crops and Number of Homes—Settlers' Success Depends on Cost of Capital

IN his annual report made public Dec. 7 Franklin K. Lane, Secretary of the Interior, summarizes the activities of the Reclamation Service for the fiscal year ended June 30, 1916. Increases in areas irrigated and cropped, and in crop values, as well as the difficulties confronting the settlers, are pointed out. In discussing the latter subject, lack of sufficient capital and its effect on the welfare of the settler are given a prominent place. The following paragraphs and tables are taken from the report.

During the last year the operation of the reclamation laws has continued to advance their objects, as shown by the increases in the area for which the service could supply water, in the areas actually irrigated and cropped, in the value of crops produced and the increase in the actual number of settlers and of homes. The progressive increase in these elements is shown in Table 1.

In summarizing the construction results accomplished during the year, increases of 230,349 acres to which the Reclamation Service was prepared to supply water, 81,328 acres for which water rights are under contract and 138,479 acres in rental contracts are mentioned. Reservoir capacity has been increased from 6,500,360 to 9,035,160 acre-feet—a gain of 2,534,800 acre-feet during the year.

DIFFICULTIES OF THE SETTLERS

Practically every annual report of the Reclamation Service has stated that the principal difficulty with which the average settler has to contend is the lack of sufficient capital. In some cases the settler may originally have had considerable capital, but his lack of experience, or other misfortune, has operated to his disadvantage until his funds have been practically exhausted. After he has acquired the necessary experience he is often unable to recover his standing for the lack of the necessary funds.

This lack of capital is felt more acutely as the area acquired or under attempted cultivation increases. The instances of success with small capital, especially in the case of inexperienced settlers, are confined almost entirely to small holdings of 40 acres or less, and perhaps no one circumstance has operated so strongly to handicap settlers in making a success upon government projects as the attempt to hold and improve too much land.

The Huntley project in Montana is conspicuously successful so far as individual prosperity is concerned. This project was handicapped by the cold climate, the usual drawbacks of refractory soil, and the characteristic desert difficulties; but it was opened under a special law which gave the secretary wide discretion, and policies were adopted which could not be applied to other projects owng to legal requirements. The size of the farm unit was in general made 40 acres. Settlers were not permitted upon the land until the water was ready for delivery, and when settlement was invited each settler was obliged to pay $1 per acre to the Indian tribe as partial payment for the land and also 10 per cent of the water charge at time of entry.

TABLE 1—RESULTS OF RECLAMATION, EXCLUSIVE OF INDIAN PROJECTS BUILT FOR INDIAN SERVICE

Year	Irrigable acreage*	Irrigated acreage	Irrigated farms	Cropped acreage	Crop value
1909..	730,000	382,000	9,000	......	....
1910..	880,000	475,000	12,000	415,000	$12,500,000
1911..	1,015,000	560,000	14,000	470,000	13,000,000
1912..	1,160,000	645,000	15,000	590,000	14,500,000
1913..	1,200,000	700,000	16,000	650,000	16,000,000
1914..	1,250,000	770,000	18,000	700,000	16,500,000
1915..	1,500,000	857,000	20,000	800,000	19,000,000

*Area Reclamation Service was prepared to supply water

These substantial payments eliminated

TABLE 2—IRRIGATION AND CROP RESULTS ON GOVERNMENT PROJECTS, 1915*

Project	Irrigable acreage	Irrigated acreage	Cropped acreage	Value of crops	
				Total	Per acre cropped
Salt River	219,691	179,350	171,832	$3,661,769	$21.31
Yuma	72,440	27,857	25,101	873,721	34.81
Orland	20,320	8,928	6,930	220,422	31.81
Uncompahgre Valley	65,000	41,463	40,553	1,044,915	25.76
Boise	150,000	76,705	69,818	1,526,873	21.87
Minidoka	120,000	83,562	77,008	1,725,515	22.41
Huntley	30,813	18,203	18,185	535,363	29.41
Milk River	22,200	4,192	3,887	51,249	13.18
Sun River	16,326	4,261	4,243	†80,000	†19.00
Lower Yellowstone	42,329	12,656	11,990	194,011	16.18
North Platte	129,714	70,007	68,130	1,263,617	18.55
Truckee-Carson	65,000	40,295	38,495	592,523	15.39
Carlsbad	24,796	13,470	11,322	245,684	21.70
Hondo	3,330	1,294	1,287	17,778	13.81
Rio Grande	45,000	33,876	32,246	1,103,389	34.22
Umatilla	17,000	5,306	3,603	104,653	29.04
Klamath	38,000	27,254	27,254	377,488	13.85
Belle Fourche	78,591	44,067	43,063	462,050	10.72
Okanogan	10,099	7,800	4,814	254,425	52.60
Yakima:					
Sunnyside unit	82,757	66,607	54,919	2,750,326	50.08
Tieton unit	34,440	22,000	18,100	668,650	37.00
Shoshone	42,816	25,753	24,833	410,031	16.51
Totals for irrigated areas covered by crop reports	1,330,222	814,906	757,613	$18,164,452	$24.00
Additional irrigated areas not covered by crop reports:					
Boise	80,000	20,422	......	....	....
Uncompahgre Valley	4,500	4,500	......	....	....
North Platte	8,050	8,050	......	....	....
Strawberry Valley	50,000	8,900	......	....	....
Totals, reclamation projects	1,472,772	856,778	......	....	....

*Data are for calendar year (irrigation season) except on Salt River project, Ariz., data are for corresponding "agricultural year," October, 1914, to September, 1915.

†Estimated.

the impecunious speculator. The settler was not compelled to live for years upon an arid homestead without water and thus dissipate his means and his patience, and he was not permitted to take more land than was necessary for his livelihood. Thus were eliminated the three principal causes of failure upon other projects.

The Shoshone project and many other projects illustrate strikingly the contrast between large and small holdings. On those projects, homesteads near railroad stations are generally made 40 acres, while farther out they contain 80 acres of irrigable land and sometimes more, up to a limit of 160 acres. In general, the individuals with the small holdings, having less tax upon their resources for improvements and water charges, have been successful. Their neighbors, similarly situated, but with larger holdings, have been unable with their means to cultivate any larger area of land during the first few years when the struggle is on, and have had the additional burden of double the water charges and heavier costs for fencing and other improvements. The results have shown a larger percentage of success and general prosperity upon the small unit.

RESULTS OF RECLAMATION

The usual data were collected at the close of the irrigation season of 1915 regarding the results being attained by the irrigators. These figures show the annual advance in the settlement and development of the government's reclamation projects. In 1915 over 1000 farms and 50,000 acres were added to the cultivation area of the various projects and irrigation water was served to 18,600 producing farms. Over 800,000 acres were irrigated and crops were harvested from over 750,000 acres.

The new lands brought into production do not reach their full yield the first year, including young orchards just coming into bearing, new alfalfa stands giving a single cutting of hay, and other fields first brought into cultivation during the season and giving partial yields while being better prepared for full production. But in spite of the large addition to the producing area in 1915 there was an increase in the average returns per acre over the preceding year. During 1915 the average for all reclamation projects in value of crops per acre was $24—an increase of 50 cents per acre in comparison with the statistics for 1914. At the same time the total production increased to more than $18,000,000.

GAIN IN 1915

The year 1915 was the first since crop statistics have been gathered on the government projects that the average crop value per acre shows a gain over the preceding year. That is, beginning with the figures for 1908 or 1909 there was a gradual reduction each year in the average reported crop value per acre until 1915, when there was a gain over 1914. This may be partially explained by the fact that the Reclamation Service began water service with a number of old irrigated tracts under canals acquired in connection with the Salt River, Uncompahgre Valley, and other projects, and each year diluted this with added raw land not giving full production, tending to step down the general average return per acre. Acting in the other direction, the raw land addition of each year has gradually reached more intensive production, so that in 1914 this factor may have balanced the other, and in 1915 the statistics have begun a trend in the other direction. It is also true that the early figures of crop production were roughly estimated, with the error naturally on the side of greater returns. There is now well established a relatively inexpensive system of collecting these data, but one probably more accurate than an ordinary census. Such data are available for the last three or four years. In these the average return is fairly constant, but has decreased slightly and now increased, with a change in any year small enough to be attributable to the many factors always affecting the business of farming.

TWO PROJECTS ADDED IN 1915

In 1915 two projects were added to those producing annual crops worth over a million dollars, the Uncompahgre Valley (Colo.), and the North Platte (Neb.-Wyo.). The Salt River project, Arizona, continues to lead in total returns with crops worth $3,660,000, closely followed by the Yakima project, Washington, producing from less than half as large an area crops estimated at $3,418,000.

TABLE 3—CROP RESULTS ON RECLAMATION PROJECTS IN 1915

Figures are limited to irrigated areas covered by crop reports, excluding about 40,000 acres irrigated but not covered by crop reports, and small areas cropped by dry farming on a few projects.

	Acreage cropped			
Crop	Total	Per cent	Yields, average per acre, bu.	Crop value, average per acre
Cereals:				
Barley	37,474	4.6	25	$15
Corn	39,785	5.3	31	20
Oats	49,514	6.5	30	13
Rye	780	0.1	14	11
Wheat	84,052	11.4	21	18
Total	211,605	27.9	.....	$17
Other grain and seed:				
Alfalfa seed ..	14,517	1.9	4.0	$32
Clover seed ...	5,537	0.7	3.6	37
Sorghum (grain) ...	7,216	1.0	35	22
Flaxseed	330	....	11	20
Millet seed ...	244	....	9	11
Total	27,844	3.6	.....	$30
Hay and forage:			Tons	
Alfalfa hay ...	335,161	44.3	2.9	$19
Clover hay ...	6,726	0.9	1.9	11
Other hay	12,484	1.6	1.4	12
Corn fodder ..	33,529	4.4	1.8	20
Peas	927	0.1	*18	31
Other forage..	870	0.1	....	....
Pasture	98,128	12.9	....	9
Total	487,825	64.3	....	$17
Vegetables and truck:			Bu.	
Beans	2,610	0.4	12	$31
Onions	324	....	204	122
Potatoes, white	17,269	2.3	165	74
Potatoes, sweet	279	....	70	41
Truck	11,481	1.5	....	67
Total	31,963	4.2	....	$68
Fruit and nuts:			Lb.	
Apples	16,502	2.2	2,500	$52
Peaches	2,326	0.3	4,600	54
Pears	1,755	0,2	5,250	89
Prunes	302	....	10,000	235
Citrus fruit...	1,167	0.2	1,850	68
Small fruit....	1,577	0.2	1,850	113
Other fruit and nuts	2,212	0.3	....	75
Total	25,927	3.4	....	$63
Miscellaneous:			Tons	
Sugar beets...	20,848	2.7	11	$59
Cotton	3,325	0.4	†385	62
Hops	545	0.1	†1,800	188
Cane	1,411	0.2	5.3	24
Other crops....	1,335	0.2	....	....
Total	27,464	3.6	....	....
Duplication ...	55,015	7.0	....	....
All crops	757,613	100.0	....	$24

*Bushels.
†Pounds.

The foregoing figures are restricted to areas covered by the water-user census or crop reports, which in general cover lands under canals operated by the Reclamation Service. On several of the projects additional areas received water developed by the project works, but delivered through canals not operated by the government. This was the case of the Strawberry Valley project, Utah, where water was delivered for the first time from the government works. In this way an additional 40,000 acres were served by the government projects, bringing the total irrigated area to about 850,000 acres. At the same time the works were capable of serving nearly 1,500,000 acres.

The areas in use and estimated returns for the separate projects are shown in Table 2.

CROPS OF 1915

The figures for 1915 (see Table 3) show no marked change in the character of crops grown or their relative areas. More than half the total cropped area is devoted to hay and forage crops, slightly less than one-third to grains, and less than 5 per cent each to fruit, vegetables, and sugar beets. The depression in the cotton market that followed the outbreak of war in Europe was reflected in a large reduction of area utilized for this crop. The later recovery in prices is not yet reflected in the statistics.

Alfalfa continues to dominate the crop statistics from the irrigated areas. In 1915 it occupied nearly half the cropped acreage and yielded more than one-third the total crop value. Its many virtues readily explain this popularity. Once established it is a hardy plant and continues almost indefinitely to furnish good annual yields without reseeding. It gives several cuttings each year. It is a legume with the peculiar power of drawing from the atmosphere the nitrogen in which the soils of the arid region are often deficient, and leaves behind more than it found of this valuable plant requirement. It is the deepest of subsoilers, penetrating with its many roots to a remarkable depth for the other essential elements of plant growth and improving the physical condition of the soil. It furnishes a hay of superior quality for conditioning and fattening stock, so effective in fact that it is now being utilized medicinally for humans.

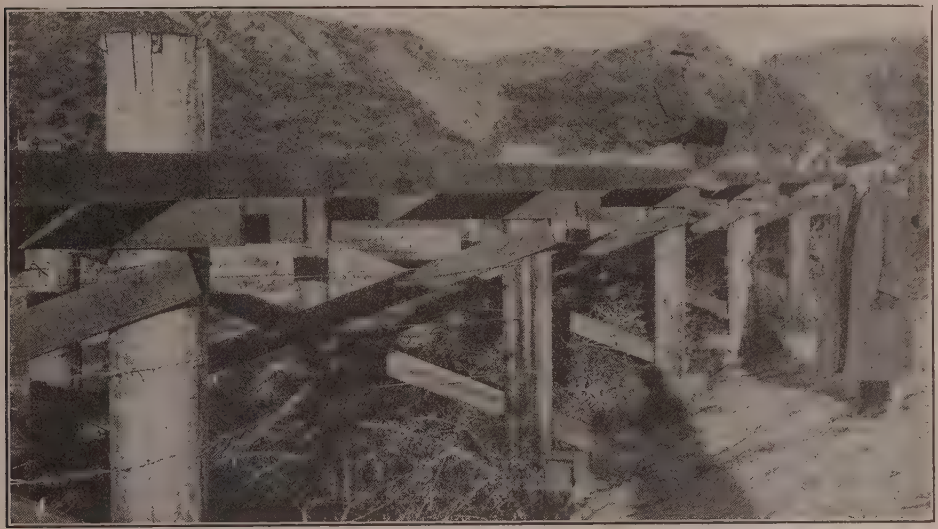
SUCCESS ON SMALL FARMS

A summary of 18,624 irrigated farms shows the average farm contains 54 acres of irrigable land, 44 acres of which are actually watered, leaving 10 acres for fields not yet utilized, buildings, private roads, etc. On this average farm 20 acres are in alfalfa, 13 in grain, with small areas of other crops. The farmer crops a total of 41 acres. His total crop as harvested is worth a little less than $1,000, but he has three or four work animals to feed and by feeding the rest of his crop its value can be greatly increased. For this purpose he has cows, sheep, and hogs—in all about 25 animals. These are worth about $1,000. Adding the price of his land and water-right payments, this average farmer is using a capital investment of $6,000. His success depends largely on what he pays for the use of this capital. If he is indebted for a large share of it at a high interest rate, he is likely to fail; if his capital is clear of indebtedness and interest is low, his chance is excellent.

Barbed Wire Helps Build River Embankments

Collects Sand Quickly on Three Miles of Pile Jetties Along Santa Maria and Santa Ynez Rivers in California

THE Santa Maria River in the southern part of California has a flood discharge in excess of 100,000 sec.-ft. It flows through a light sandy plain with a slope of 10 or 15 ft. per mile, and the conditions are such that a deep channel has never formed. The average channel depth below the natural bank is from 10 to 20 ft. In recent years the development of areas adjacent to this stream has made it desirable to fix the location of the channel at certain points by means of some type of jetty suitable for use in sandy formation. After some study of conditions Haviland & Tibbetts, civil engineers, of San Francisco, designed a jetty consisting of piles and barbed wire calculated to collect enough drift and detritus to build up the solid structure desired.



ROWS OF PILING WOUND WITH BARBED WIRE FOR CATCHING DÉBRIS AND FORMING JETTY

The piles were placed in a double row 10 ft. apart and each pair was spaced 12 ft. apart longitudinally. After the piles were driven about 20 ft. in the sandy bottom they were tied together by means of 2 x 6-in. cross-braces. Four of these braces were placed transversely between each pair of piles, two being horizontal and the other two inclined. Longitudinally four lines of 2 x 6s were run along each row of piles, two at the tops, and two where the piles entered the ground. With this wood framing in place, a brush mat about 3 ft. deep was placed between the rows of piling, and barb wire was then strung diagonally from pile to pile and also longitudinally along the outside of the piles, the wires being spaced about 1 ft. apart vertically.

About 3 miles of jetties of this type were built on the Santa Maria and Santa Ynez Rivers at an average cost of about $4 per linear foot in place. The barb wire quickly catches floating débris, which has the effect of increasing the height of the brush mattress, and this increases the tendency to collect and hold flood detritus.

This type of construction is reported to be giving very satisfactory service. In fact some of these jetties projecting about 6 ft. above ground have been completely buried in sand during the first few hours submerged.

Girders Act as Railing in Overhead Crossing

Arlington Avenue Bridge, Indianapolis, Economically Designed to Carry Street Loading Without Sidewalks or Car Tracks

UTILIZING the main girders for railings, with recessed panels on the outside, an economical form of reinforced-concrete overhead highway viaduct has been designed for the Arlington Avenue crossing over the Pittsburgh, Cincinnati, Chicago & St. Louis Railway (Pennsylvania Lines West of Pittsburgh) in Indianapolis, Ind. Eight spans 37 ft. center to center of columns, with girders, beams and piers exactly alike except at the ends and at the central expansion joint, are used for the 296-ft. total length of the structure. No end abutments are provided; the earthfill approach is carried right up to the end piers and around them on a 1½:1 slope, reaching beyond the next intermediate piers. At the center line of the symmetrical structure an expansion joint is furnished by double columns and roadway beams with 1-in. clearance between them. These details are illustrated in the drawing at the bottom of the page.

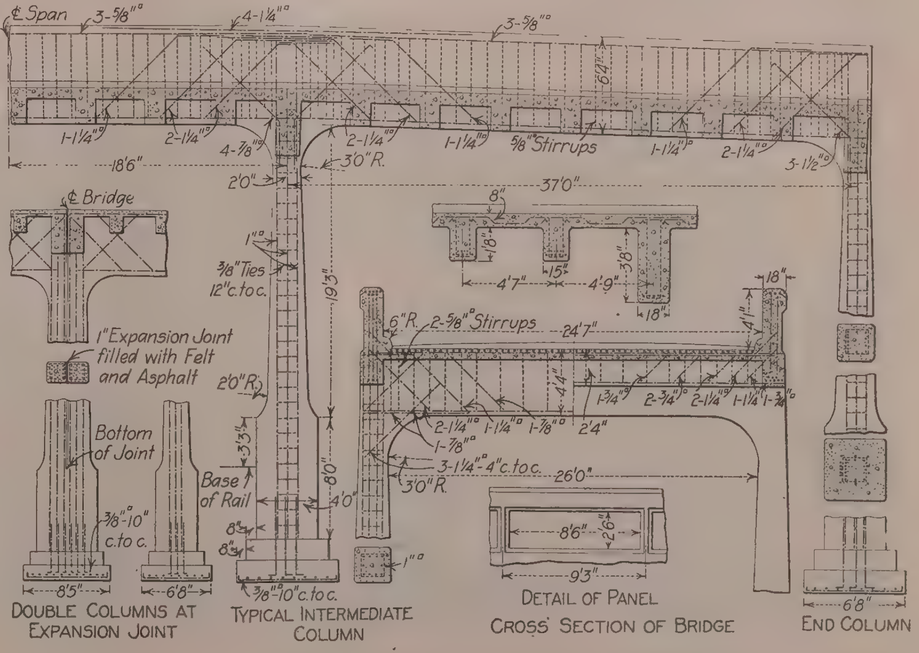
A roadway 24 ft. 7 in. wide between girders and 23 ft. 6 in. between curbs, with no sidewalks, is provided by using outside main girders and columns spaced 26 ft. on centers. As shown in the drawing, these main girders are carried above the 8-in. roadway slab a distance of 4 ft. to act as a side rail. On the outside a paneled effect is produced by 3-in. recesses. Intermediate transverse 15 x 28-in. floorbeams spaced 4 ft. 7 in. on centers are detailed with their lower faces flush with the bottom of the main girders. The floorbeams at the columns are made 2 ft. deeper, with curved brackets at their end connections to add transverse rigidity to the structure.

The bridge is designed for a uniform live load of 125 lb. per square foot of roadway and for a 20-ton road roller. No provision is made for electric railway loading. The main girders are designed as continuous beams. The column foundations are carried to hardpan by ordinary spread footings.

DOUBLE COLUMNS AT EXPANSION JOINT

On the center line of the structure a 1-in. expansion joint is provided by double columns and transverse beams, as shown on the drawing, the column joint above the piers to be filled with felt and asphalt. The floorbeams at this point are each made 18 in. wide, and the amount of steel reduced, since less strength is required. A single foundation is used for the double column, as indicated on the drawing.

This economical overhead crossing was designed under the direction of J. C. Bland, engineer of bridges, Pennsylvania Lines West of Pittsburgh. The contractor is the Dunn-McCarthy Company, of Chicago.



SECTIONAL ELEVATION AND TYPICAL DETAILS OF 37-FOOT SPANS—GIRDERS USED AS RAILINGS

Granite Curbing Replaced by Concrete

Granite curbing is gradually being replaced in San Francisco by armored concrete curbing, according to the latest report of the city engineer, who states that the change effects a reduction in cost of about 50 per cent and a distinctive gain in general appearance.

Build Monolithic Brick Road on One-Inch Base

Narrow Country Road Needs Small-Sized Equipment and Minimum of Aggregate for Thin, Granular, Easily Shaped Base

IN ACCORDANCE with the theory that a dry, compacted earth roadbed without any material depth of foundation will, by itself, sustain country traffic, Stockland Township, Iroquois County, Illinois, is building 5 miles of monolithic brick road 9 ft. wide, on a concrete base 1 in. thick. Carried to the limit from the structural standpoint, no base would be used, for the compacted soil is counted upon to take the load, and the brick is to act simply as a surfacing material, keeping the earth foundation dry. This means extraordinary pains to insure deep side ditches. The purpose of the thin layer of concrete, which can hardly be termed a base or foundation, is not to hold the brick nor to bear weight, but to make a smooth surface on which to lay the brick and one on which the grout will stop.

CONSISTENCY OF THIN GRANULAR BASE MOST IMPORTANT

As in the Vermilion County brick roads, described in the Engineering Record of Sept. 30, page 400, and in which article the Stockland road is noted, wire-cut-lug brick are laid directly on the wet concrete within 20 ft. of the mixer. A 1:2½:4 mixture is used, the large material being roofing gravel passing a ½-in. screen and remaining on a ¼-in. screen. The moisture consistency is considered of the greatest importance. It is such that the mix will just run down a 30-deg. grade of the Boss mixer spout. It is then struck off with a hand template which is cut back 8 to 10 in. to permit a zigzag motion, as illustrated in one of the photographs. The base is so thin and the mixture so granular that if the water content is right the bricks are easily sustained, thus giving a smooth surface.

An Anyweight water roller weighing 25 lb. to the linear inch is used within 6 to 8 ft. of the brick layers to take out any small irregularities. The roller is pushed transversely across the brick rather than lengthwise, because it is considered that the sidewise rolling is like sliding two straightedges together to produce a straight line. In other words, as the roller approaches the end of one row of bricks it rests on the center of adjacent rows. In the lengthwise rolling the roller jumps over the joints from one row of bricks to another, thus tending to rock the individual brick.

The grouting was done with a small Marsh-Capron mixer, using practically the same procedure as was followed in the Vermilion County work. A 1:1 mix of cement, fine plaster and sand, of the consistency of cream, is spread directly from the mixer into the joints with a brush. The second coat is applied from wheelbarrows as soon as the first coat is settled but not set up. The third coat should be the filler left on top of the bricks from the other two coats and squeezed into the joints to fill them flush with the top. It is the aim to keep the grouting operation within from 100 to 200 ft. of the brick layers.

Some of the construction advantages noted on this work are the small mixer required for the foundation work and the small amount of aggregate needed, the latter materially reducing the teaming item.

The work is being carried out for the township by Bishop & Liddell, contractors, Danville, Ill.

ABSENCE OF LARGE AGGREGATE PILES IS CONSPICUOUS

Proposes Complete Specifications for the Structural-Steel Work of Buildings

Clauses Are Included to Cover the Often-Ignored Details Which Are the Usual Source of Difficulties and Misunderstandings

By R. FLEMING
New York City

WHILE it is possible to present a form which can be used as a guide in writing specifications for the structural-steel work of buildings, it is not practicable to draw up a specification that will apply to all cases. Modifications should be made to suit the specific building under consideration. For instance, a few lines headed "Description" should be given in place of the "Classification" included in the specifications here proposed. For an office building, that which relates solely to mill buildings should be omitted, and vice versa; in fact, all that is irrelevant to the particular building in question should be left out.

The terms of payment, dates of delivery, and method of settling questions arising between purchaser and contractor belong to the contract proper, and need not be repeated in the specifications.

Great care should be given to the preparation of Clause 3, on "Scope of Work." This section should be clear and complete. It should be definitely stated whether stacks, tanks, elevator framing, stairs, and similar items are included or excluded. Any special feature to be emphasized should be stated. It may seem to some that sections relating to design might be omitted in specifications for the contractor. This is often done when design drawings are furnished, but the practice is not to be commended. When making detail drawings it is an advantage to know the loads, stresses and other data upon which the design is based. In structures of unusual importance Clauses 51 and 53, on details and workmanship, should be elaborated.

Specifications for the steelwork of buildings are seldom written without drawing upon the work of others, and the following are not exceptions. In fact, they are largely a matter of selection, with such additions and modifications as the writer deems advisable. Values have been assigned to bolts acting in tension and to countersunk and flattened rivets. The last sentence of Clause 43 meets the case of replacing the lacing of four-angle latticed columns with web plates without violating a building code because of increased slenderness ratio l/r. In Clause 47 the limits of deflection are given as 1/24 and 1/32, instead of the usual 1/20 and 1/30. This allows 8-in. I-floorbeams and 6-in. channel purlins for 16-ft. bays—a very common practice, regardless of specifications. Similar modifications are made throughout, the object being a set of specifications that can and must be followed.

GENERAL REQUIREMENTS

1. *Drawings*—The drawings forming a part of these specifications are (giving number, maker, title and date of each drawing).

2. *Classification*—For the purpose of classification buildings are divided into two classes—(1) mill buildings; (2) office buildings.

Under Class 1 are included manufacturing plants, machine shops, power houses, train and pier sheds, electric-light stations, armories, and buildings of similar character.

Under Class 2 are included office buildings, hotels, apartment houses, stores, warehouses, places of public assembly, and buildings of similar character.

3. *Scope of Work*—It is intended that these specifications and drawings cover the structural-steel work complete for the building. Cast-iron bases are included with the structural steel. The steel erector shall erect in place the steel framework on foundations furnished by others. Anchor bolts and loose lintels are to be delivered at the site, but put in place by other contractors.

MATERIALS TO BE FURNISHED

4. The materials to be furnished for buildings of Class 1 include steel trusses, columns, purlins, bracing, floor framing, crane girders with rails, trolley beams, lintels, girts, framing around door and window openings, beams supporting tanks, elevator framing, stair framing, floor plates, bunker framing and steel lining, stairs and railings unless of an ornamental character, cast-iron bases, grillage beams and anchor bolts.

The materials not furnished include ornamental iron and steelwork, mason's anchors, carpenter's anchors and irons, elevator sheave beams, switches for trolley beams, steel stacks, steel tanks, and reinforcing rods and bars for concrete.

5. The materials to be furnished for buildings of Class 2 include steel columns, cast-iron bases, rolled and cast-steel slabs, grillage beams, anchor bolts, floor framing, roof and ceiling framing, purlins, cornice supports, supports for tanks, penthouse framing, bracing and lintels.

The materials not furnished include ornamental iron and steelwork, mason's anchors, terra-cotta anchors, carpenter's anchors and irons, stair work, elevator framing, elevator sheave beams, steel stacks, steel tanks, light shapes supporting metal ceiling lath, cast-iron sills, and similar work, and reinforcing rods and bars for concrete.

6. Rivets and bolts for fastening steel to steel (but not for connecting the work of other trades) shall be furnished by the steel contractor. Fitting-up bolts for erection are to be considered a part of the erector's equipment, and need not be furnished by the steel contractor.

COLUMN-FOOTING PLAN

7. As soon as possible a column-footing plan shall be sent to the purchaser, showing the location, elevation and dimensions of all column bases, with the location, elevation, size and length of all anchor bolts The loads coming upon the column footings from the columns shall also be given.

8. Crane-clearance diagrams showing the clearances assumed for traveling cranes shall be furnished the purchaser at an early date.

9. *Substitution of Material*—If the contractor wishes to substitute other shapes or sizes for those called for on the drawings he may do so, subject to the approval of the engineer, provided the architectural features are maintained and proposed sections are sufficient to carry the required loads.

10. *Work of Other Trades*—Holes conforming to the usual standards of fabrication shall be punched in the steel for attaching the work of other trades, provided their location is given while the working drawings are being made.

11. *Working Drawings*—Working or shop drawings shall be made by the steel contractor, and prints in duplicate sent to the purchaser or his engineer for approval. The engineer's approval of drawings shall cover general design, strength and type of details. The engineer shall not be held responsible for the fit of work at the site. If, to expedite delivery, or for any other reason, he waives the approval of drawings, the contractor will not be relieved of responsibility for errors or omissions due to neglect or oversight on his (the contractor's) part.

12. All work must conform to local or state ordinances and regulations.

LOADS FOR ROOFS

13. Unless governed by a local building code the following loads shall be used:

Roof trusses and columns shall be designed to carry a uniform load per square foot of exposed roof surface, applied vertically. This load includes the weight of the structure, the snow, and the wind. For spans up to and including 80 ft., and in climates corresponding to that of New York, the total minimum uniform load per square foot of roof surface for different kinds of covering shall be taken as follows:

	Lb.
Corrugated metal	40
Gravel or composition roofing on wood sheathing	50
Slate on boards	50
Tile on steel purlins	55
Tar and gravel on cinder concrete	60
Slate or tile on cinder concrete	65

14. For roof spans over 80 ft. the above-cited loads shall be increased 1 per cent for every foot increase of span.

15. For roofs in climates where snow is excessive 5 to 10 lb. shall be added, and in climates where no snow is liable to occur 10 lb. may be deducted from the foregoing loads.

16. If a ceiling is carried by the lower chord, the ceiling load shall be assumed at not less than 10 lb. per square foot.

17. If shafting is carried by the lower chord, the load at the shaft shall be assumed at not less than 2000 lb. for light shafting, 4000 lb. for ordinary shafting, and 6000 lb. for heavy shafting. Unless the shafting is definitely located these loads shall be considered as liable to be concentrated at any point of the lower chord.

18. In designing purlins carrying roof covering only, the loads in Clauses 13 and 15 may be decreased 5 lb. and considered normal to the roof. When the pitch of the roof is more than $2\frac{1}{2}$ in. to 1 ft., tie rods shall be used between the purlins.

19. Special loadings, such as tanks or elevator supports above the roof and hoists or trolleys on the lower chord, shall be taken into consideration.

20. The stresses obtained from concentrated loads shall be added to those due to uniform load.

21. Flat roofs used as places of public assembly shall be considered as floors.

FLOOR LOADS

22. *Floors*—Floor loads consist of dead load and live load. The dead load is composed of the weight of the floor construction and of any permanent wall resting upon it. In designing floorbeams and girders for fireproof construction the dead load shall be assumed at not less than 70 lb. per square foot. Partitions of wood studding or hollow tile not more than 6 in. thick may be considered as part of the live load.

23. Buildings of Class 1 shall be designed for minimum live loads per square foot of floor area, as follows:

	Lb.
Mold lofts, pattern and template shops	60
Machine shops	120 to 175
Factories	120 to 250
Warehouses	200 to 500
Foundries—charging floor	300
Power houses	200

24. Provision shall be made for the support of machinery, engines, boilers, tanks, and other concentrated loads when carried by the steel construction.

25. Stresses due to traveling cranes and machines tending to cause vibration shall be increased 25 per cent. (For hand-power cranes, impact may be taken at 10 per cent.)

26. Buildings of Class 2 shall be designed for minimum live loads per square foot of floor area as follows:

	Lb.
Dwelling and apartment houses	40
Hotels and offices—first floor	75
Hotels and offices—upper floors	50
School rooms and churches	75
Places of public assembly, where floors are used for drilling or dancing	100
Where not so used	80
Retail stores —ordinary	100
Public garages	100

27. Concentrated loads, such as heavy safes, special fixtures, machinery, auto trucks, shall be taken into consideration. Every steel beam in any floor used for business purposes shall be capable of sustaining a live load concentrated at its center of not less than 4000 lb.

COLUMN LOADS

28. *Columns*—Every column, post, or other vertical support, shall be of sufficient strength to carry the combined live and dead loads transmitted to it. In buildings of five or more stories in height where all the floors are not liable to be loaded at the same time it shall be permissible in designing columns to assume the live load on the floor next below the top floor at 95 per cent of the allowable live load, on the next lower floor at 90 per cent, and on each succeeding lower floor at correspondingly decreasing percentages until 50 per cent is reached, which reduced load shall be used for all remaining floors.

29. In calculating column loads no reduction of floor area shall be made for stair wells.

30. In proportioning columns provision shall be made for eccentric loading.

31. *Wind Pressure*—All steel buildings shall be designed to carry wind pressure to the ground by steel framework.

Buildings of Class 1 not over 25 ft. to the eave line shall be designed to resist a horizontal wind pressure of 15 lb. per square foot on the sides of the building, and the corresponding normal component on the roof according to the Duchemin formula for wind pressure on inclined surfaces,

$$p = P \frac{2 \sin A}{1 + \sin^2 A}$$

Where buildings are more than 25 ft. to the eave line the horizontal pressure shall be taken at 20 lb. per square foot and the corresponding normal component on the roof.

Buildings of Class 2 in which the height is more than three times the minimum horizontal dimension shall be designed to resist a horizontal wind pressure of 20 lb. per square foot on the sides of the building and the corresponding normal component on the roof according to the Duchemin formula.

Only the excess of the wind stresses obtained by this paragraph over the wind stresses according to Clause 13 need be considered. In arriving at this excess, the wind included in the total uniform loads designated in Clause 13 shall be assumed at 10 lb. per square foot.

32. The normal pressure, p, in pounds per square foot on a surface inclined A degrees to the horizontal for a horizontal wind pressure, P, of 20 lb. per square foot, according to the Duchemin formula, is as follows:

A	p	A	p
5°	3.4	25°	14.4
10°	6.8	½ pitch	14.9
15°	9.7	30°	16.0
⅓ pitch	11.5	40°	18.2
20°	12.1	45° to 90°	20.0

33. The area of circular steel stacks subject to wind pressure shall be assumed to be 55 per cent of the diametral area.

34. Coal bunkers shall be assumed to be surcharged when it is possible for them to be so loaded. The weight of anthracite coal shall be taken at no less than 50 lb. per cubic foot and the angle of repose assumed to be 30 deg.

ALLOWABLE UNIT STRESSES

35. Unless governed by a local building code, the following unit stresses, in pounds per square inch of sectional area, shall not be exceeded for stresses due to the combined dead and live loads together with impact:

Tension, net section rolled steel	16,000
Direct compression, rolled steel and steel castings	16,000
Bending on extreme fibers of rolled shapes, built sections, girders, and steel castings	16,000
Bending on extreme fibers of pins	24,000
Shear on shop rivets and pins	12,000
Shear on bolts and field rivets	10,000
Shear—average—on webs of plate girders and rolled beams, gross section	10,000
Bearing pressure on shop rivets and pins	24,000
Bearing on bolts and field rivets	20,000
Rivets used in tension	5,000
Bolts used in tension, net section under thread	10,000
Axial compression on gross section of columns:	
For l/r from 0 to 60	13,000
For l/r from 60 to 120	$19{,}000 - 100\ l/r$
For l/r from 120 to 160	$13{,}000 - 50\ l/r$

Where l = effective length of member in inches;
r = least radius of gyration of section in inches.

36. For combined stresses due to bending and direct loads, the foregoing unit stresses may be increased 20 per cent, provided the section thus obtained is not less than that required for bending or direct stress alone. For combined stresses due to wind and other loads the above-mentioned unit stresses may be increased 50 per cent, provided the section thus obtained is not less than that required if wind forces be neglected.

COUNTERSUNK RIVETS

37. Countersunk rivets in plates of thickness equal to or greater than one-half the diameter of rivet shall be assumed to have three-fourths the value of rivets with full heads. In plates of thickness less than one-half the diameter of rivet their values shall be taken as three-eighths that of full-headed rivets.

Rivets with flattened heads of height not less than ⅜ in., or one-half the diameter of the rivet for ⅝-in. rivets and less, shall be assumed to have nine-tenths the value of corresponding rivets with full heads. Rivets with heads flattened to less than these heights shall be regarded as countersunk rivets.

38. The allowable pressure of column bases and bearing plates on masonry shall not exceed, in pounds per square inch, the following:

On brickwork with cement mortar	250
On brickwork with lime mortar	150
On Portland-cement concrete 1:2:4 mixture	600
On Portland-cement concrete 1:3:5 mixture	350
On first-class dimension sandstone or limestone	400
On first-class granite	600

PROPORTION OF PARTS

39. Trusses shall preferably be riveted structures. Tension as well as compression members shall preferably be composed of rolled shapes or built-up sections. Flat bars shall not be used.

40. In calculating tension members, net sections shall be used. The diameter of rivet holes shall be assumed to be ⅛ in. larger than the nominal size of the rivet. In single angles connected by one leg, the net area of the connected leg and one-half that of the outstanding leg shall be considered effective.

41. The nominal sizes of rivets shall be used in calculations of their values.

Rivets and bolts in tension shall be avoided as far as practicable. In cases where they cannot be avoided and the loads carried are subject to shock, bolts with check nuts shall be used.

REVERSAL OF STRESS

42. Members subject to reversal of stress shall be proportioned for the stress requiring the larger section, but their connections shall be proportioned for the larger stress plus one-half the smaller.

43. The effective length of main compression members shall not exceed 120 times their least radius of gyration, and for secondary members and lateral bracing 160 times their least radius of gyration. Any portion of the cross-section of a compression member may be neglected in computing the radius of gyration, provided that portion be neglected in computing the safe load.

44. Plate girders may be proportioned upon the assumption that the bending stresses are resisted by the flanges and that the shear is resisted by the web. One-eighth of the gross area of the web may be considered to act as flange area. Plate girders may also be proportioned by their moments of inertia.

CRANE-LOAD DISTRIBUTION

45. Wheel loads of cranes shall be assumed to be distributed on the top flanges of runway girders over a distance equal to the depth of the girder, with a maximum of 30 in. In addition to the vertical load, the top flanges shall be designed to resist a horizontal thrust of 20 per cent of the lifting capacity of the crane, equally divided among the four or more wheels of the crane.

46. Plate-girder webs shall have a thickness not less than 1/160 of the unsupported distance between flange angles. Web stiffeners shall be used in pairs. They shall be placed over bearings, at points of concentrated loading, and at other points where R is greater than 90 or where the shearing stress per square inch is greater than that obtained from the formula $10{,}000 - 50R$, R being the ratio of depth of unsupported web to its thickness. They should generally be not farther apart than the depth of the unsupported web.

Stiffeners shall be designed as columns for a length equal to one-half the depth of the girder and shall have enough rivets properly to transmit the shear. When important loads are transmitted through the bearing of stiffeners, the bearing value shall be assumed at 24,000 lb. per square inch of section, excluding the area of chamfered portion over fillets of flange angles.

47. The depth of girders and rolled beams in floors shall be not less than 1/24 of the span, and if used as roof purlins shall be not less than 1/32 of the span. In case of floors subject to shocks and vibrations the depth shall be limited to 1/16 of the span.

48. When the laterally unsupported length, l, of the compression flange of beams and girders exceeds 15 times its width, b, the unit stress in the compression flange shall not exceed $19{,}000 - 250l/b$.

49. Steel purlins shall be single rolled shapes, plate girders or lattice girders.

50. Steel less than ¼ in. thick shall not be used. This does not apply to fillers or to webs of rolled beams and channels. Steel subject to the action of harmful gases or severe atmospheric conditions shall be not less than 5/16 in. thick.

51. Details throughout shall conform to first-class standard practice.

MATERIAL AND WORKMANSHIP

52. *Material*—Steel shall be made by the open-hearth process and shall have an ultimate tensile strength of 56,000 to 64,000 lb. per square inch. In general, steel and cast iron shall conform to the "Specifications for Steel Railway Bridges" adopted by the American Railway Engineering Association.

53. *Workmanship* — All workmanship shall be first class in every respect and in accordance with practice followed by the best modern bridge shops.

54. *Painting*—All steelwork shall be thoroughly cleaned before leaving the shop. Steelwork to be entirely embedded in concrete and cast iron shall not be painted. Other steelwork shall be given one coat of red lead and linseed oil or a graphite paint, as directed. One coat shall be given in the shop to surfaces inaccessible after assembling. Machine-finished surfaces shall be coated with white lead and tallow before shipment.

55. After erection the steelwork shall be cleaned of all dirt and rust and given one coat of graphite paint of color or shade different from that of the shop coat.

56. All painting at shop and site shall be done by hand when the surface of the metal is perfectly dry. Painting shall not be done in freezing weather.

INSPECTION AND ERECTION

57. *Inspection*—All inspection and tests shall be made at the option and expense of the purchaser.

58. If material is tested at the mills, the necessary number of test pieces and the use of a testing machine shall be furnished free of charge by the steel contractor.

59. The purchaser or his representative shall have free access at all times to the mills where material is rolled and to the shops where it is fabricated. In ample time

for his needs he shall be given dates of mill and shop operations and furnished with complete working drawings.

60. *Erection*—The structural steel and iron, except anchor bolts and loose lintels, shall be erected by the steel contractor on foundations furnished by the purchaser.

61. Care shall be taken that all steelwork be level and plumb before riveting.

62. Proper provision shall be made for resisting stresses due to erection operations.

63. Field connections generally shall be riveted. Purlins and girts, except those forming part of the bracing, may be bolted. Where there is little or no vibration in floors, connections 3 ft. or more from column centers may be bolted.

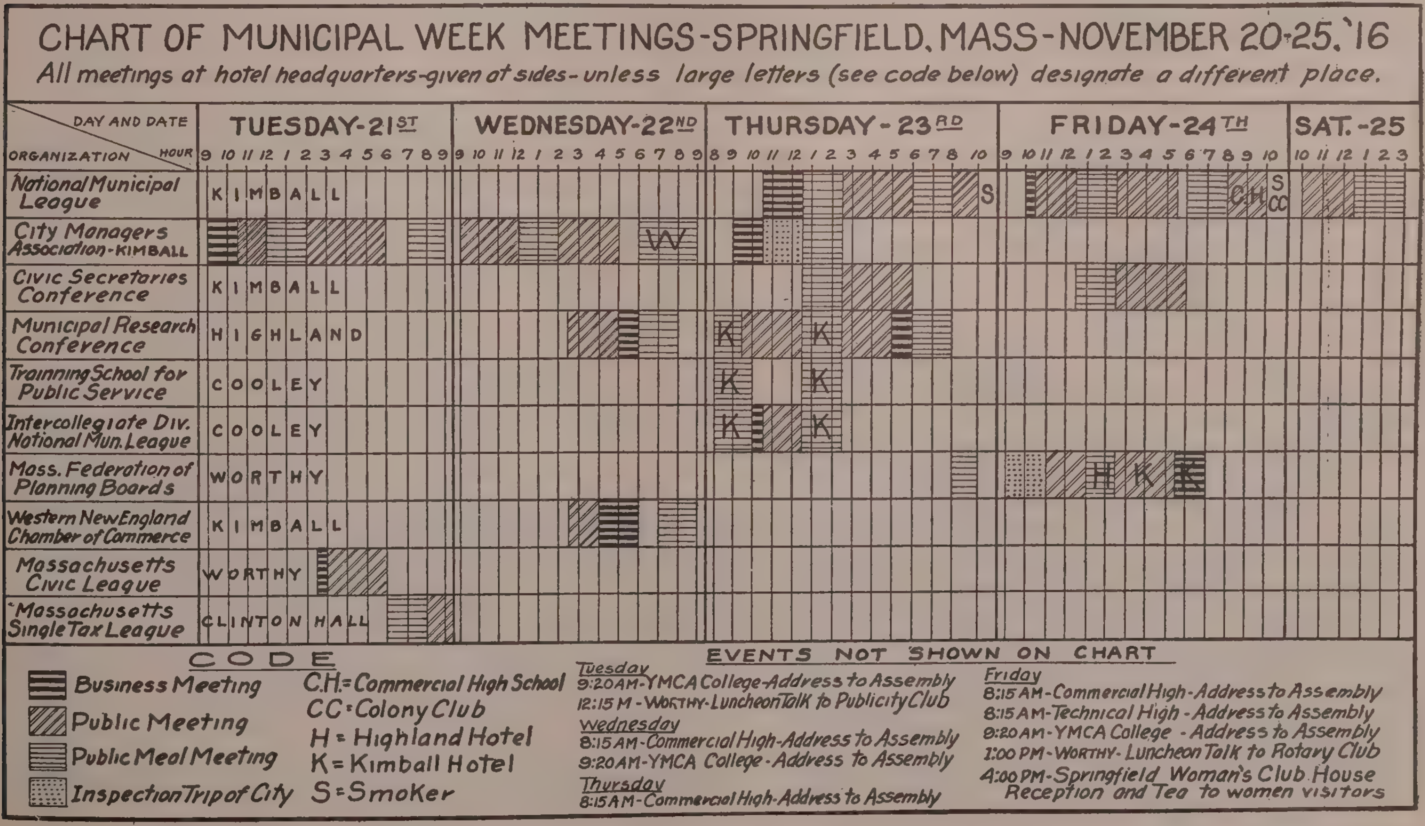
64. Drift pins shall be used only to bring parts together. Unfair holes shall be made to match by reaming.

65. After finishing work the erector shall remove his equipment and all rubbish resulting from his operations.

City Managers Chart Convention Program

Graphic Schedule of Events During Municipal Week at Springfield Helps Delegates Choose Meetings to Attend

A CONVENTION program in the form of a small chart was one of the features of Municipal Week at Springfield, Mass., Nov. 20 to 25. Ten organizations, including the City Managers' Association and the National Municipal League, held meetings in the New England city simultaneously. To avoid confusion in the interpretation of the printed program, a chart was prepared as shown. These were printed on cardboard and distributed to members. Because of the number of associations holding sessions during Municipal Week, many of the programs overlapped. The chart showed at a glance what meetings occurred at the same time, and delegates were therefore able to select the one they wished to attend. As will be noted from the illustration, various conventions were adopted to differentiate business meetings, public meetings, trips of inspection, etc.



CODE

▤ Business Meeting
▨ Public Meeting
▤ Public Meal Meeting
▒ Inspection Trip of City

C.H.=Commercial High School
CC=Colony Club
H=Highland Hotel
K=Kimball Hotel
S=Smoker

EVENTS NOT SHOWN ON CHART

Tuesday
9:20 AM-YMCA College-Address to Assembly
12:15 M-WORTHY-Luncheon Talk to Publicity Club
Wednesday
8:15 AM-Commercial High-Address to Assembly
9:20 AM-YMCA College-Address to Assembly
Thursday
8:15 AM-Commercial High-Address to Assembly
Friday
8:15 AM-Commercial High-Address to Assembly
8:15 AM-Technical High-Address to Assembly
9:20 AM-YMCA College-Address to Assembly
1:00 PM-WORTHY-Luncheon Talk to Rotary Club
4:00 PM-Springfield Woman's Club House Reception and Tea to women visitors

CHART TO GUIDE CONVENTION DELEGATES IN SELECTING MEETINGS TO ATTEND DURING MUNICIPAL WEEK AT SPRINGFIELD, MASS.

Will Divert 1400 Additional Second-Feet at Niagara

Hope Thereby to Relieve Situation at Buffalo, Made Acute Because Canada Has Denied Energy to American Industries

RECOGNIZING the urgent necessity for additional electrical power in Buffalo, N. Y., Secretary Baker of the war department recently authorized the Niagara Falls (N. Y.) Power Company to divert an additional 1400 sec.-ft. of water from the river during the peak-load hours in the morning and afternoon. The Canadian government has stopped the exportation of large blocks of Canadian-Niagara power to American consumers, and never before has there been such a shortage of power in western New York as during the last thirty days.

Under the provisions of the special agreement with the war department all additional power generated by the Niagara Falls Power Company must be sent to Buffalo in an effort to relieve the power situation until the first unit of the new steam plant of the Buffalo General Electric Company is placed in operation. This special permission expires on Jan. 1, 1917.

After a recent hearing in Buffalo, at which practically all the large industries of the city were represented, Devoe P. Hodson, member of the New York Public Service Commission, Second District, was so impressed with the seriousness of the situation that he immediately sent a telegram to the federal authorities urging temporary relief by an additional diversion of water from the Niagara River at the Falls. Charles R. Huntley, president of the Buffalo General Electric Company, and other representatives of large industries in western New York also went to Washington and made a personal appeal to have the situation relieved.

LIGHTING POWER SCARCE

Many large Buffalo industries have been forced to suspend operations early in the afternoon because of their inability to get sufficient light and power. Thousands of homes in Buffalo have been unable to get electricity for light during the peak-load hours of the late afternoon. City streets, reports state, have not been lighted until hours after dark because of the situation. The losses to Buffalo industries within the last month or so will reach more than $1,000,000, it is estimated. Not only has Buffalo felt the effects of the Canadian embargo, but large electrochemical industries in Niagara Falls have been forced to make personal appeals to the Dominion authorities for energy to keep their plants in operation.

The Acheson Graphite Company, of Niagara Falls, N. Y., which has large war orders to furnish electrodes to the British government, entered a formal protest to the Ontario Hydroelectric Commission against the embargo on power exportation. W. Acheson Smith, vice-president of the company, received a reply from the Canadian authorities in which the Ontario commission said it could do nothing to protect American industries so long as there is increased demand for electric power throughout the province of Ontario.

SHORTAGE OF POWER AT BUFFALO

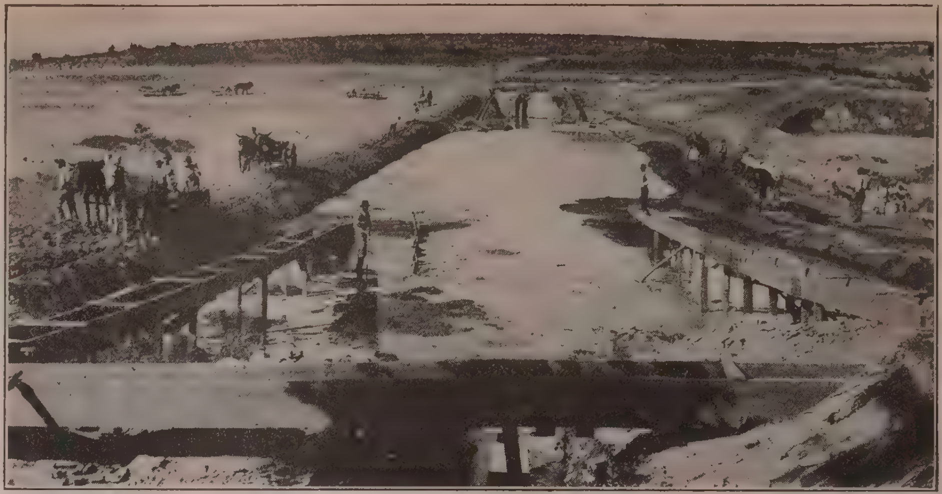
About three months ago the Ontario government was asked for additional power by Canadian munitions factories, and a demand was made upon the Canadian Niagara Power Company for a larger supply. The company agreed to furnish 50,000 hp. after a threat had been made to stop all exportation. The Canadian Niagara company is supplying only 35,000 hp., and the commission has demanded the additional 15,000 hp. at once. Already an embargo has been placed on more than 18,000 hp. formerly sent to Buffalo and other western New York cities, with the result that American generating companies have been unable to fill the increased demands that have been made upon them.

90,000 Horsepower Needed

There is a demand for 84,000 hp. in Buffalo. What is being supplied is 37,500 hp. from the Niagara Falls Power Company, 13,000 from the Toronto Power Company, 13,000 additional from the latter company when there is no other demand for it, and 1000 hp. from the Niagara Falls Power Company, generated under a temporary permit which expires when the first unit of the new Buffalo General Electric Company steam plant is in operation. The maximum supply received is 78,500 hp., but this amount is not available where there is the greatest demand. This month, the commission's expert said, there will be a demand for 90,000 hp. It is expected that the first unit of the Buffalo General Electric Company's steam plant, generating approximately 25,000 hp., will be in operation this month.

Pipe-Joint Leakage

In the article entitled "Committee Wants Data on Pipe-Joint Leakage to Check $4,000,000 Annual Waste," in the Engineering Record of Nov. 18, page 616, a typographical error occurred in stating the leakage from a pipe line at Grandview, Ohio (third column, first paragraph). Instead of 131 gal. per inch-mile per day the leakage should have been stated as 0.31 gal. per inch-mile per day, the latter figure representing a condition of almost bottle-tightness.

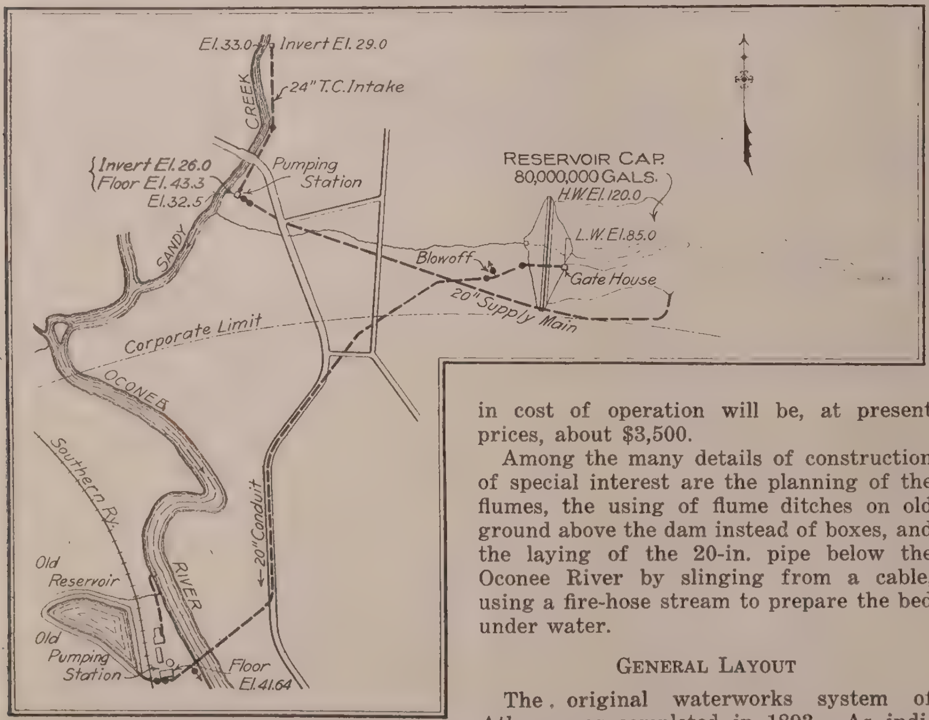


FILLING HEART OF DAM BETWEEN EMBANKMENTS BY THE HYDRAULIC METHOD

Reservoir Capacity Increased and Construction Cost of Dam Decreased by Hydraulic Sluicing

Saving in Operating Cost Resulting from New Source of Supply Is Estimated to Pay for Extending Waterworks System at Athens, Ga.

LOW construction cost and increased reservoir capacity resulted from the adoption of hydraulic sluicing methods in placing the earthfill dam for the new storage reservoir at Athens, Ga.—part of the plan for extending the waterworks system by which it is hoped to save about one-half of the operating cost of the filters for the water-supply system of this city of 22,000 population. By proper sedimentation facilities and the changing of the source of supply from Oconee River to Sandy Creek this decrease in the cost of the alum and liquid chlorine for clearing and sterilizing the water, it is estimated, will pay the interest on the new expenditure and furnish a sinking fund for retiring the bonds issued by the city to finance the project. The total cost, including property bought, is $45,000, and it is estimated that the saving per year in cost of operation will be, at present prices, about $3,500.



RELATIVE LOCATION OF NEW AND OLD RESERVOIRS

Among the many details of construction of special interest are the planning of the flumes, the using of flume ditches on old ground above the dam instead of boxes, and the laying of the 20-in. pipe below the Oconee River by slinging from a cable, using a fire-hose stream to prepare the bed under water.

General Layout

The original waterworks system of Athens was completed in 1893. As indicated by the plan, the old pumping station was located on the west side of the Oconee River, just below a 15,000,000-gal. reservoir into which water from the river was pumped. From here the water was carried to a coagulation basin and treated by Warren filters of 3,000,000-gal. daily capacity. In recent years the continual muddy condition of this river, owing to deforestation and the nature of the soil, caused an exceptional increase in the operating cost of the filter—the alum and liquid chlorine bills alone amounting to $9,000 for the past year.

Another reason for changing the source of supply was the fact that the new towns of Commerce and Jefferson on the Oconee River above Athens were discharging increasing amounts of sewage into the stream.

Better Source of Supply

Sandy Creek, a tributary ½ mile above the old station, with a minimum flow of 15,000,000 gal. per day of relatively clear and uncontaminated water, simplified the problem of how to improve the character of the supply and at the same time decrease operating expenses. A favorable site for a storage and sedimentation reservoir, as indicated on the plan, was located so as to give sufficient grade to overcome friction in the 20-in. conduit connected by gravity flow with the old pumping station.

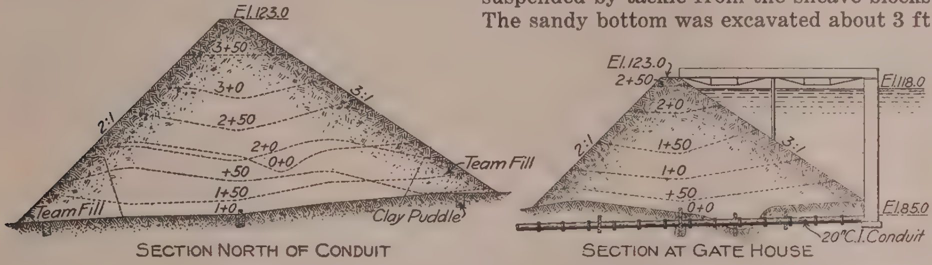
The new pumping station, located on the bank of the creek at an elevation about 5 ft. above high-water level, is designed for a direct-connected 200-hp. motor-driven volute pump of 8,000,000 gal. daily capacity. The intake is located about 1000 ft. farther up Sandy Creek in order to get above a dairy and slaughter pen near this site. The intake pipe is double-strength terra cotta of 24 in. diameter. The 20-in. supply main was laid in an open ditch from the power house to the point of discharge in the reservoir about 1000 ft. above the outlet at the gate house near the dam.

Earth Dam Constructed by Sluicing

In order to increase the capacity of the new reservoir and at the same time decrease the cost of constructing the earthfill dam, a sluicing method was adopted. Two low team-placed earthfills were constructed, with clay puddle walls as noted in the sections, at the upstream and downstream limits of the dam, and the water of the stream from a small spring (100,000 gal. per day) impounded to a depth of about 15 ft. This water was used over and over by the two 6-in. centrifugal pumps of 50 hp., installed one on each side of the pond. They furnished 1600 gal. per minute each, discharging through movable one-man monitor nozzles, as shown in the photograph. The sand and clay soil was easily loosened and carried through ditches and wooden flumes to the outer slopes of the dam, where the heavy particles were deposited and the fine silt drifted to the center, forming an impervious core.

TOP PLACED BY TEAMS

A slope of 3 ft. per 100 was necessary in constructing these flumes, which were 2 ft. wide and 12 in. deep and flowed half full, and hence the soil was obtained from high banks on the side of the hill as the dam increased in height. Water was returned to the pond by ditches in the old ground above the dam. Finally, as the height increased, the retaining fills placed on the two faces of the dam by teams came together, and the top was placed by teams only, using clay. An 18-in. concrete core wall was carried down to firm rock and up about 1 ft. above the original ground level. Around this core wall and above it was deposited the fine silt formed in the separation of materials by the sluicing method.



SECTION NORTH OF CONDUIT

SECTION AT GATE HOUSE

SECTIONS OF DAM—UPSTREAM AND DOWNSTREAM EMBANKMENTS TO RETAIN SLUICED MATERIAL

The 80,000,000-gal. reservoir thus produced serves the conduit of 8,000,000-gal. capacity through gates in a concrete gate house, shown in section, with a blowoff and two valves located as shown on the plan. The entire reservoir is protected from surface water by hillside ditches, to prevent overflow, and will be sodded on the slopes above. One of the advantages of the sluicing method lies in the thorough saturation of the earth in the dam, including the clay puddle walls. As the present consumption in Athens is about 2,000,000 gal. per day, the present filter capacity of 3,000,000 gal. is ample.

LAYING PIPE UNDER OCONEE RIVER BY SUSPENDING FROM CABLE

One of the illustrations shows the method used for placing the 20-in. riveted steel pipe used, instead of cast iron, for the section under the Oconee River. The steel cable was anchored by deadmen back of the simple timber A-frames shown, and the three sections of pipe and the bends were suspended by tackle from the sheave blocks. The sandy bottom was excavated about 3 ft. and the final level for the pipe obtained by using a firehose stream to force material under water from around the pipe. An asphalt coating was placed on the inside and outside of the pipe, which was spiral-riveted and connected by elbows to the cast-iron pipe on each side of the river.

Work was begun on the clearing of the site on May 1. In 96 working days about 55,000 cu. yd. of material was placed. About 40,000 cu. yd. of material in the dam was moved by sluicing at an approximate cost of 12 cents per cubic yard. Teams placed about 25,000 cu. yd.

The design was made by J. W. Barnett, for twenty-five years city engineer of Athens, and the construction by day labor was done under his direct supervision. James Barrow, superintendent of the waterworks department, collaborated with Mr. Barnett on this project.

Court Construes Pumping as "Stopping Leaks"

When Leaks in Coffer Floor Could Not Be Stopped, Contractor Used More Pumps and Collected for Extra Work

IN A DECISION handed down by the U. S. Court of Claims, Nov. 20, it was held that a clause in the contract providing for extra payment in case it should be necessary to stop leaks through the floor of the large cofferdam in which the government ship lock at Black Rock Harbor, Buffalo, N. Y., was constructed covered the cost of extra pumping which was found necessary to control such leaks. According to the terms of this decision the United States government is required to pay the MacArthur Brothers Company, contractor for the lock, $36,385.90, held by the Court to be the portion of the sum claimed by the plaintiff which he was entitled to recover on this clause plus 15 per cent profit. The original claim was for $54,748.79.

The opinion in the case, which was argued for the plaintiff by George A. King of Washington, D. C., and Henry W. MacGee of Chicago, was given by Judge Hay and concurred in by the other judges, and follows in part:

CASE REVIEWED

"The contract was entered into on the fifteenth day of April, 1908. The plaintiff constructed a cofferdam, as required by the specifications, and upon completion it was found to be tight and efficient and served throughout the progress of the work to exclude the water down to bedrock. On March 22, 1909, the plaintiff started to pump out the cofferdam, and on April 15, 1909, the water was lowered to the bottom of the clay filling in the cofferdam.

"As soon as the water had been lowered to the bottom of the clay filling, large leaks developed in the bedrock. The water came up in large quantities at many places throughout the entire bedrock forming the floor of the inclosure. Paragraph 52 of the specifications is as follows: 'If any leaks develop through the bedrock or through the cofferdam below the clay filling when the inclosure is being pumped out, the contractor shall stop them under the terms and agreements for payment therefor to be made with the engineer, based upon the actual cost of labor and materials at current wages and prices, plus not exceeding 15 per cent for profit.'

"The plaintiff, when these large leaks developed in the cofferdam inclosure, notified the engineer in charge of the work in

UPSTREAM FILL FOR DAM BEGUN BY TEAMS

WASHING SAND AND CLAY SOIL FROM UPPER BANKS writing of their existence, and certain plans and agreements for stopping the leaks were considered and adopted. These plans were approved by the engineer officer as methods of stopping the leaks under paragraph 52 cited above, and the plaintiff was paid the sum of $8,327.39 for the labor and material used in these methods for stopping the leaks. These methods, however, were only partially successful.

"The plaintiff on July 31, 1909, wrote a letter to the engineer officer in charge of the work, setting forth that the only method of dealing with these leaks was to increase the existing pumping capacity. While the engineer officer did not accept this proposition of the plaintiff, yet he permitted the additional pumping to go on without protest and without suggesting any other method of stopping the leaks, and indeed acquiesced in this method of stopping the leaks as being the only one which would permit the continuance and completion of the work. It is contended by the defendants that the pumping operations were not recognized as being a part of the work of stopping leaks and that the payment of the amount claimed by the petition is prohibited by paragraph 7 of the specifications, which is as follows: 'It is understood and agreed that the quantities given in these specifications are approximate only, and that no claim shall be made against the United States on account of any excess or deficiency, absolute or relative, in the same. No allowance will be made for the failure of a bidder or of the contractor to estimate correctly the difficulties attending the execution of the work.'

PUMPING NECESSARY

"But the Court is of the opinion that paragraph 7 does not control the labor and material used by the plaintiff in stopping leaks, for it clearly appears that the pumping process was necessary for controlling the leaks and to complete the work which the plaintiff had undertaken to perform. Therefore paragraph 52, which dealt with the stoppage of leaks, is the part of the contract which must be looked to in the disposal of this claim. That paragraph does not provide that the plans and agreements for stopping leaks shall be in writing. It only requires that the plans shall be agreed upon, and if they were agreed upon orally, or if all of the plans agreed upon had been tried and the pumping process had been resorted to by the plaintiff after he notified the engineer in charge of the work that that was the only method which was feasible for the purpose, and the engineer acquiesced by permitting the pumping to continue without protest, this would be a sufficient compliance with the provisions of paragraph 52 to entitle the plaintiff to a recovery.

"Paragraph 51 of the specifications is as follows: 'The contractor shall furnish and maintain at least two good and efficient pumping outfits, with pumps, engines, and supplies complete, for pumping out the inclosure and for keeping it drained to bedrock, as may be required, while his contract is in force.'

"It is contended by the defendants that under this paragraph it was the duty of the plaintiff to completely unwater the cofferdam, and that no claim could be made for extra pumping until this was done. This contention cannot be allowed for the reasons above stated, that the extra pumping was the method adopted by consent of the parties for stopping the leaks."

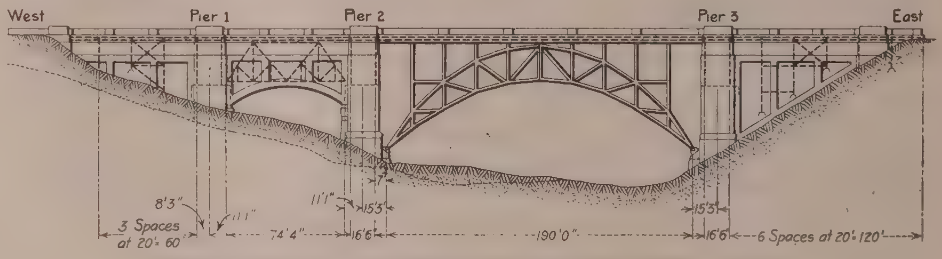
Approaches of Bloor Street Viaduct, Toronto, Have Concrete-Covered Steel Frames

Massive Appearance Produced by Deeply Paneled Concrete Facing of Side Spans Leading to Double-Deck Steel Arches

By W. F. B. RUBIDGE
Formerly Resident Engineer, Dominion Bridge Company, Toronto, Canada

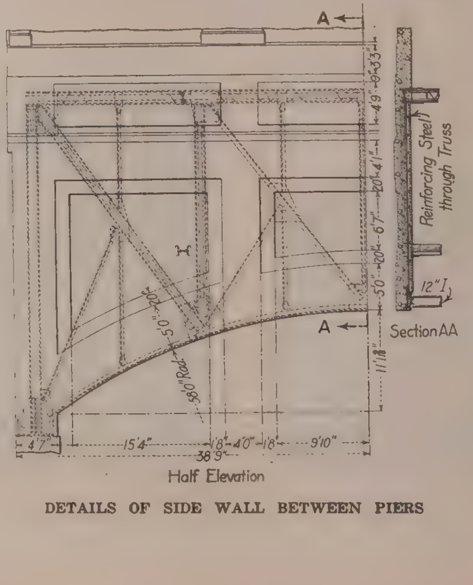
APPROACHES to both the Rosedale section and the Don section of the Bloor Street viaduct in Toronto, Canada, are alike in the use of deeply paneled concrete facing on steel trusses, in order to give a massive effect to the spans leading to the main 190-ft. steel arches. The structure is a highway bridge of the double-deck type, with provision for future traffic on the lower deck. Foundation and profile conditions led to special details. For example, in the Rosedale section of the viaduct, here described, the west approach contains steel trusses covered by concrete, while the east approach is faced by vertical reinforced-concrete slabs on beams.

In 1914 the city of Toronto called for tenders for the construction of a viaduct across the Rosedale Ravine and the Don Valley, and invited designs in reinforced concrete and reinforced concrete and steel. The contract was finally let early in 1915 for structures which combine both designs, the approaches being of reinforced concrete and the main spans of three-hinged steel arches. The design adopted was prepared by the railway and bridge section of the works department of the city. The structure is designed with a lower deck for future underground railway traffic.



GENERAL ELEVATION OF ROSEDALE SECTION—BLOOR STREET VIADUCT

The foundations of all the pedestals, side walls, abutments and pier 1 on the west are of the ordinary spread type. For the main piers the foundations were carried down to bedrock, which is a hard shale at about 35 ft. below grade. Each pedestal to take the thrust from each arch rib on pier 3 is 10 ft. wide and 28 ft. long on top, battering to 30 ft. at the bottom. Small pedestals, 4 x 7 ft. on the outside, were designed to carry the outside portion of the pier. The ground on the north side was found to be so hard and uniform that the small pedestal on this side was omitted. Pier 2 is the same, except that the pedestals are 10 x 32 ft. and the small pedestals at both ends were required.

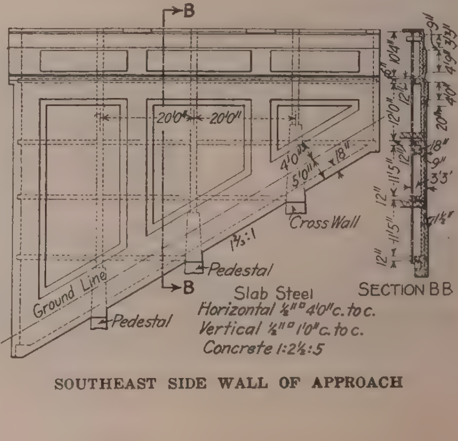


DETAILS OF SIDE WALL BETWEEN PIERS

The bridge is 86 ft. wide out to out of handrailing, with two sidewalks 10 ft. 9 in. wide and two 20-ft. roadways on either side of a 14-ft. 6-in. space in the center for car tracks. The bridge is a double-deck structure, the difference in elevation of grades of the lower and upper deck systems being 22 ft. The deck on the east and west approaches is carried by columns spaced 20 ft. center to center along the axis of the bridge and 22 ft. transversely, which gives a short span under the sidewalk slabs, with beams bearing at one end on the side wall. On the piers the column spacing along the center line is reduced to 16 ft. 6 in. On the west approach 80-ft. through trusses for the underground service carry the top deck on the top chord. The soffit, which is on a radius of 58 ft., is suspended from the bottom chord of these trusses.

MASSIVE EFFECT OF APPROACHES

One of the striking features of this bridge is the massive effect produced by the side walls of the approaches. These walls are paneled to give relief to the large areas. Sections shown herewith give the main dimensions of the walls. It will be noticed that the exposed surfaces are vertical; also, that the back is vertical for a distance of 12 ft. 4 in., from which



SOUTHEAST SIDE WALL OF APPROACH

point it batters ¼ in. to the foot. The paneling and general dimensions are the same for all the walls. These walls are tied in laterally, about the center, to the cross-wall up to a point 22 ft. below the top-deck grade. Additional ties are provided to stiffen the wall against deflection under heavy wind loads, by latticed steel struts framing into the columns. Ample provision is made for expansion at each end of the wall in the abutment and pier, the sliding surfaces being of zinc.

The southeast side wall presents a number of unique conditions. Owing to the large amount of fill placed south of the center line, this wall could not economically be carried on spread footings similar to the other walls. In places more than 30 ft. of wall would have been underground. The south pedestals, which are 7 ft. 6 in. by 17 ft. 6 in., are of a twin character, the column bearing on the north pedestal and the side wall on the south. This wall is in reality a vertical slab, with girders and beams all in the vertical plane; a drawing shows the arrangement of these girders and beams. The vertical reactions due to the dead load of the wall and dead and live load from the deck floor system are carried by the abutment, cross-wall, pedestals and pier. The panels for wind loading extend between the pedestals, the latticed steel struts and the deck of the bridge.

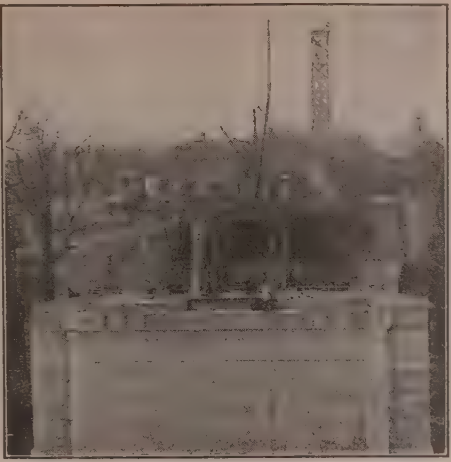
EXPANSION POCKETS

On the approach side of pier 3 the expansion pocket for the side walls commences at a point 5 ft. below the finished ground line and extends to the deck of the bridge. Additional reinforcing was placed in the back walls to provide for the pressure of the earth. On the west side, pier 2 supports the 80-ft. span and the side walls on buttresses forming part of the main pier.

The side walls between piers 1 and 2 are carried on steel trusses, which are shown dotted in one of the drawings. The steel framing is punched to permit the reinforcing steel to pass through it. The relation of the concrete paneling and steelwork is indicated in the cross-section. The trusses are tied into the main trusses by latticed steel struts. All structural steel in the concrete is wrapped with expanded metal.

The course of the center line of the bridge with reference to the center line of Bloor Street made it necessary to place the westerly side of the bridge on a curve of 315.6-ft. radius. From the west abutment there are 60 ft. of retaining wall of the buttress type and 94 ft. of the cantilever type.

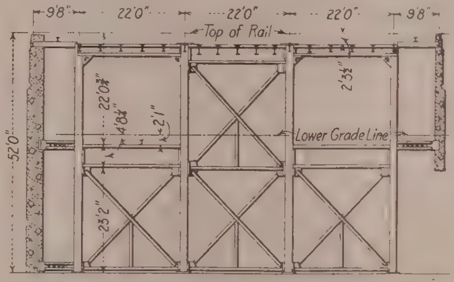
SOUTHEAST SIDE WALL DURING CONSTRUCTION



ERECTING INTERIOR TRUSSES—WEST APPROACH BETWEEN PIERS 1 AND 2

The finish on all exposed parts of the concrete is obtained by rubbing with carborundum blocks as soon as the forms are stripped. The handrailing for the 190-ft. span is carried on lattice girders, which are incased in concrete. Expansion is provided at each pier.

The proportions for the concrete are as follows: Piers and foundations, 1:3:5; massive reinforced walls, 1:2½:5, and piers between decks, 1:2:4.



CROSS-SECTION OF EAST APPROACH

This work is being carried out under the direction of the City Department of Public Works, Bridge and Railway Section, of which R. C. Harris is commissioner; G. A. McCarthy, chief engineer, and T. Taylor, designing and construction engineer. For the Rosedale section the Dominion Bridge Company, Ltd., is the general contractor. The Raymond Construction Company, Ltd., is the subcontractor for the excavation and concrete work. The writer was resident engineer for the contractor.

Geological Survey Says Our Nitrate Is Without Value

The hope that an adequate and reliable supply of nitrate deposits might be found in the United States met disappointment Nov. 19, when the U. S. Geological Survey announced that the nitrate deposits in the country were worthless for practical or commercial utilization. The judgment officially arrived at by government experts, after a careful examination, means that if we should go to war we would have to depend on the nitrate industry of Chile for the raw product from which to obtain nitric acid, or else erect nitric-acid plants for the fixation of atmospheric nitrogen.

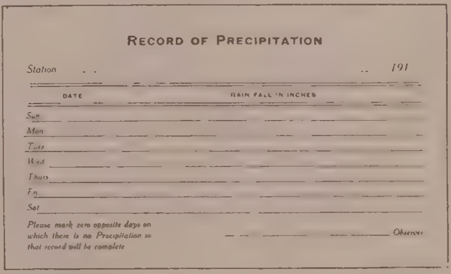
Record Hydraulic Data on Printed Post Cards

New England Power Company Gets Data from Fifteen Stations on Deerfield River on Ordinary U. S. Mailing Cards

TO KEEP a close check on stream flow at all times the New England Power Company maintains six precipitation and nine gaging stations on the Deerfield River, where five hydroelectric plants are operated in Connecticut. These gaging and precipitation stations outside the generating stations are provided with printed post cards on which data showing daily heights of water and rainfall are recorded. The printed cards, shown in the illustrations, are mailed to the dispatching office at Millbury, Mass. Using ordinary postal cards effects a saving in paper, stamps and office work. When the rainfall reaches 0.25 in. or more during the twenty-four hours, the data are telegraphed to the dispatcher.

By the work of the load-dispatching organization, the rainfall occurring at different times on the watersheds is made to benefit all the consumers on the combined systems. The interconnection of plants and the control of water from a central point also permit a reduction in operating expenses and assure better service by reducing to a minimum the possibility of total interruption at any time from line troubles or otherwise. The investment, and consequently the cost of power, can be reduced by combinations, and operating expenses can be decreased by rendering repairs easier, owing to greater facilities for shutting down. The union of adjacent water powers enables neighboring power markets to be more effectively interconnected, assuring thereby steadier levels of supply and demand.

Summaries are constantly maintained of all the causes of operating disturbance. Daily reports of operation and bulletins are forwarded from Millbury to the general manager's office at Worcester, showing all important statistics of production, water flow, reservoir conditions, load factors, probable production on date of bulletin, delivery of energy in kilowatt-hours to each customer and for the month to date, steam and purchased power used, service events and percentage data.



RECORD OF PRECIPITATION

Station 191

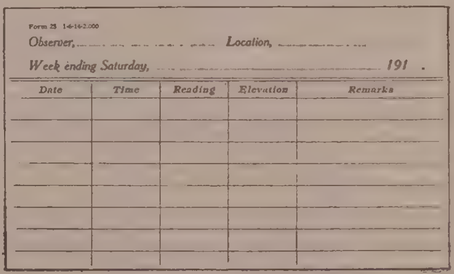
DATE RAIN FALL IN INCHES

Sun
Mon
Tues
Wed
Thurs
Fri
Sat

Please mark zero opposite days on which there is no Precipitation so that record will be complete

Observer

RAINFALL DATA POST CARD



Form 25 1-6-14-2,000

Observer, Location,

Week ending Saturday, 191 .

Date	Time	Reading	Elevation	Remarks

GAGING-STATION REPORT

COFFERDAM FOR HEADGATES PUMPED OUT—TEMPORARY BRIDGE IS ON LINE OF DAM

Diversion-Weir-Canal Type Used for Pioneer Hydroelectric Development in Sandy Soil

Low-Head Dam on Sand Bottom of Middle Loup River Near Boelus, Nebraska, Rests on Piles and Has Cutoff Walls of Steel and Wood Sheeting

A DIVERSION DAM resting on a pile foundation in sandy soil 100 ft. deep is a feature of the first important hydroelectric development in Nebraska, that of the Central Power Company on the Middle Loup River. For the sandy streams peculiar to several Middle Western states the diversion-weir-canal type of power development is the only possible one. The project itself is a pioneer development, and but few dams of this type have been built for any purpose in this country.

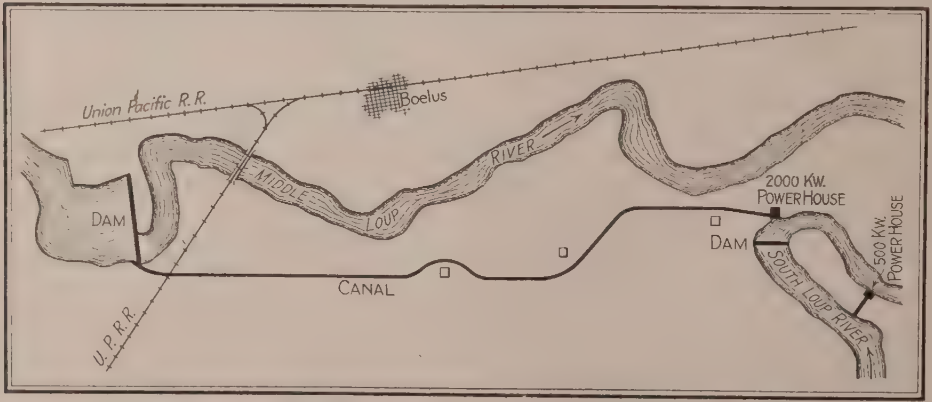
WATER DIVERTED THROUGH CANAL TO SOUTH LOUP RIVER

The development will take over the load from a 2000-kw. steam plant at Grand Island, acquired by the Central Power Company from the Grand Island Electric Company in August, 1915, at the time the former company was organized to take over the water development begun by the L. E. Meyers Company in February, 1915. The enlarged steam plant will be maintained as a reserve, and the main distribution will be from this point.

The river level will be raised 5 ft. by the diversion dam, located a short distance above the crossing of the Pleasanton branch of the Union Pacific Railroad, and the water drawn into a canal 5 ft. below normal river level, giving a depth of 10 ft. in the canal. The water will follow this canal about 3 miles to the main 2500-kw. power house on the South Loup River, where a head of 28 ft. will be developed. No wasteway has been provided at the power house, all surplus water going over the dam. In order to divert the South Loup River, primarily for the purpose of relieving the main plant of difficulties due to flood water in the tailrace, a small dam is also being built on the South Loup River just above the main power house. Advantage will be taken of the channel, cut across a neck of land inside a meander above the small dam, to develop 500 kw. on a 10-ft. head at a second power house.

DAM RESTS ON PILES

Since the site of the dam is mostly sand to a depth of at least 100 ft., it was necessary to build the concrete structure on a pile foundation. At the south end of this concrete section, as shown in the drawing, four sluiceway openings occupy 62 ft. Two of these openings have steel gates with hand-operated racks, and the two nearest the spillway are provided with stoplogs. This sluiceway provides a means of controlling the flood level of the river to avoid overflowing the branch of the Union Pacific Railroad north of the dam, while the crest of the structure is high enough to impound sufficient water to keep the canal full at all times. The rest of the dam is an overflow section 43 ft. wide. Both it and the sluiceway are protected from underwash by steel sheeting 40 ft. long under the crest and by Wakefield wood sheeting driven to 30-ft. penetration 10 ft. from the downstream edge of the apron. From foundation line to the top of the concrete the dam is 10 ft. in height. Above this level are 3 ft. of flashboards to be taken out by high water. The apron tapers from 3 ft. thick below the crest to 18 in. at the downstream edge. The piles which support it are 40 ft. in length and spaced on 10-ft. centers. The apron is reinforced with ¾-in. rods running both straight and diagonally between the piles. The spillway section contains 2600 cu. yd. of concrete, and the headgates and sluiceway 1700 yd.



SMALL PLANT BYPRODUCT OF NECESSARY DIVERSION TO KEEP FLOOD WATERS OF RIVER FROM INTERFERING WITH OPERATION OF MAIN PLANT

The north end of the dam is an earthfill 3000 ft. in length, into which the steel sheeting is continued north from the concrete portion for a distance of 200 ft. This fill is 20 ft. wide on top with a 3 to 1 slope on the upstream and a 2 to 1 slope on the downstream side. Where the wash strikes it on the upstream side it will be paved with concrete.

On the south end at right angles to the spillway section are the headgates, which are controlled by stoplogs. The trash racks which protect the five gates are arranged so as to act also as ice guards. A concrete walk 8 to 10 ft. wide across the headgates and sluiceway provides a mounting for the gate rigging and contains openings through which the stoplogs are handled.

CANAL PARTLY LEVEED

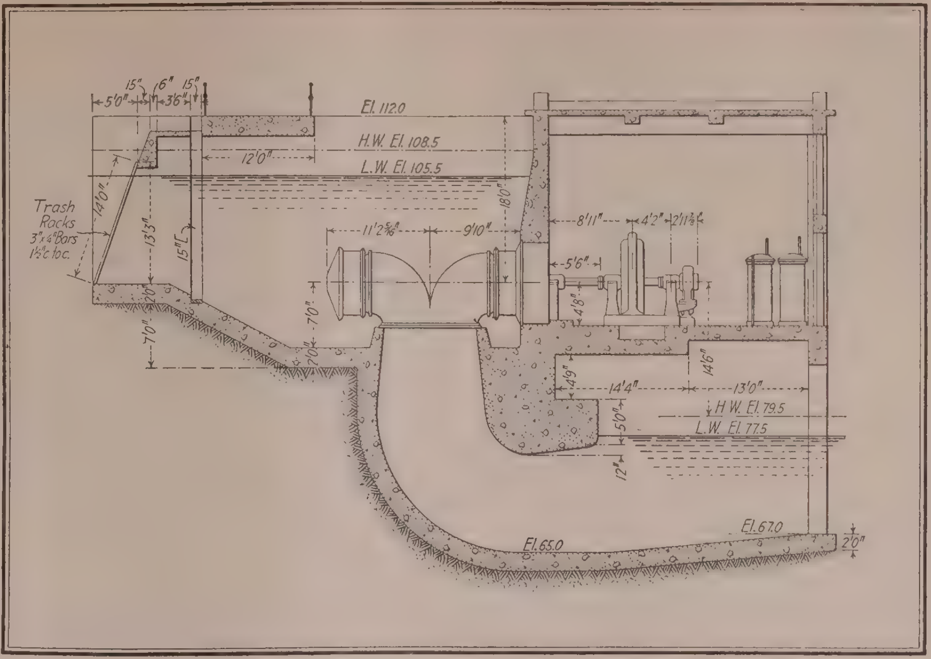
The canal which takes water from these headgates is 30 ft. wide on the bottom, with 2½ to 1 side slopes for the first half mile and 2 to 1 slopes thereafter. Passing water at 10-ft. depth, it has a fall of 3 ft. between the dam and the power house. For some 10,000 ft. it was necessary to build dikes in order to provide sufficient margin for the required depth, the minimum cut being 5 ft. The deepest cut is approximately 22 ft. The canal passes for the first half mile through fine sand, and for the rest of the way is almost entirely in yellow clay. About 400,000 cu. yd. was removed in building it. At its lower end the canal widens into a small forebay 500 ft. wide by 1000 ft. long.

The power house, built chiefly of reinforced concrete, contains a central wall of concrete 3 ft. thick, which divides the room containing the generators from the wheelpits. There are two of the latter, each 20 ft. wide, 50 ft. long and from 18 to 25 ft. deep. In each is mounted a horizontal turbine, the discharge from which is carried through the floor into a draft tube 10 ft. in diameter, from which it is discharged horizontally into the flumes under the section of the power house containing the generators. These discharge openings are 20 ft. wide and 11 ft. high. The walls of the wheelpits are of reinforced concrete and taper from 2 ft. thick at the base to 9 in. at the top. A concrete bridge designed to carry a 20-ton roller was built across the flumes and was taken advantage of to support the trash racks and stoplogs. These are located on the canal side of the bridge. Both wheelpits receive water through a flume 60 ft. wide and 16 ft. deep on its west end. This flume extends 20 ft. further than was at first intended, in order to end the concrete-lined portion in more suitable soil. The distance from its west end to the river face of the power house is 100 ft.

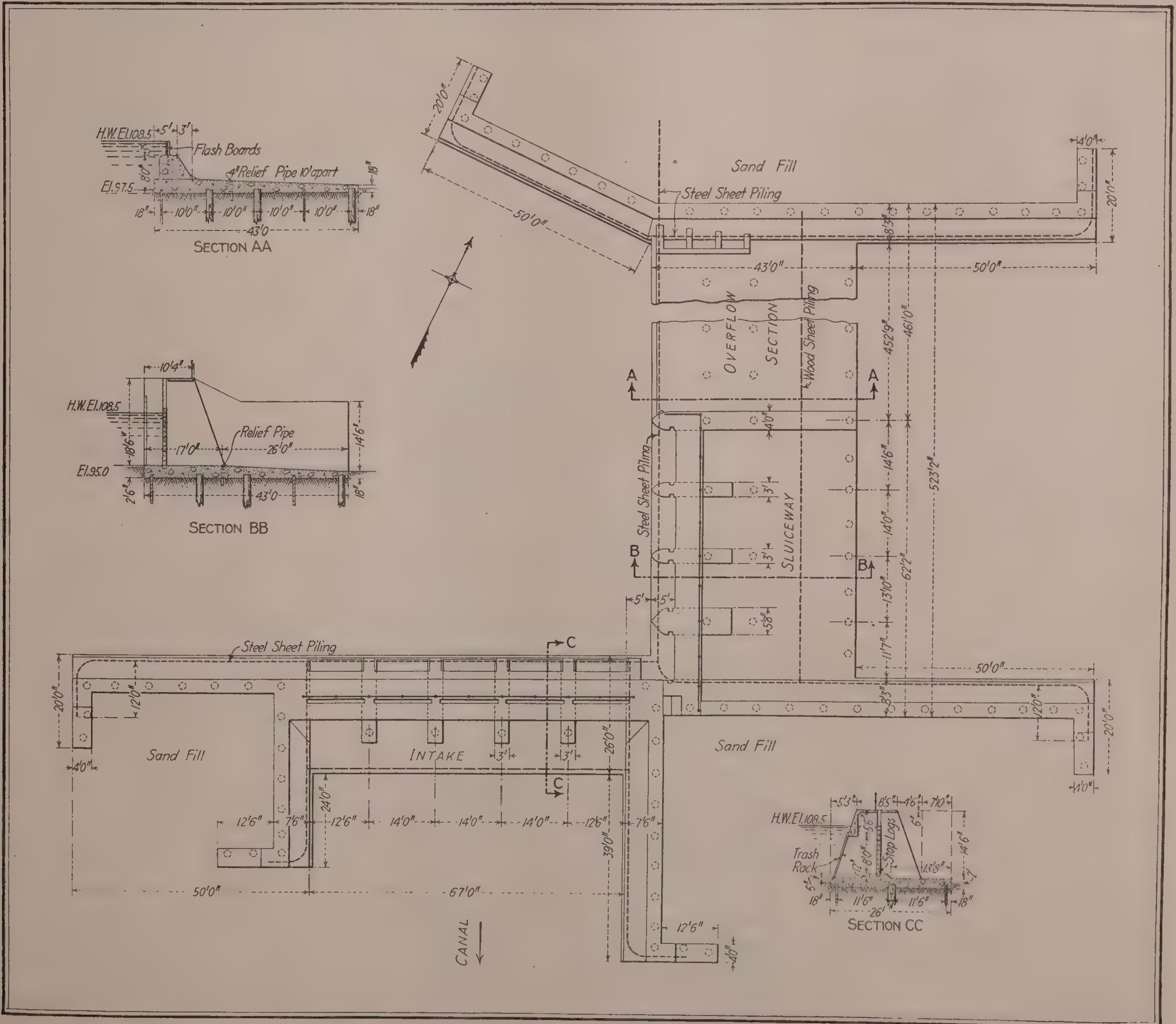
Great difficulty was experienced both in driving the cofferdam and in keeping soft material from flowing into it during the construction of the power-house foundations. The excavation extended 16 ft. below river level, and the external pressure developed was considerable. Though little water entered the excavation, every small crack that developed would let in a yard or more of material in a few minutes, and a close watch had to be kept on the sheeting. The 1200 yd. of cofferdam excavation was removed by shoveling into buckets handled with a derrick. As soon as the excavation reached grade, 2 ft. of concrete was poured over the bottom and against the sheeting on all sides. The side walls were then carried up a few feet at a time, the bracing being removed and put back between the walls. The draft-tube forms were then placed and the space between them and the side walls filled with concrete.

TWO WHEELS ON EACH SHAFT

Two 42-in. diameter horizontal wheels are mounted on each shaft. Each wheel develops 1500 hp. when passing 630 cu. ft. of water per minute, making 180 r.p.m. This will develop 1250 kw. for each of the two generators. Each unit is direct-connected to its own exciter, besides which a 50-kw. motor-driven exciter is provided to serve both generators. The generating room also



TWO WHEELS MOUNTED ON SAME SHAFT DRIVE 1250-KILOWATT UNIT



DAM FOUNDED ON PILES IN SAND, RIVER BED RAISES WATER 5 FEET TO LEVEL OF CANAL, WHICH TAKES IT TO 28-FOOT-HEAD POWER PLANT contains the three 750-kw. water-cooled transformers, which step the current up from 2300 volts to the line pressure of 33,000 volts. The high-tension lines are carried out of the building through roof bushings, from which they pass through choke coils and airbrake switches mounted on the roof to the transmission line.

The control panel for the small plant on the South Loup River is located in the switchboard of this building, and the latter plant will be floated on the line without a governor and without any special attendant.

Draglines Excavate Canal

The earth portion of the main dam was built last year and a start made on the concrete portion. The latter was constructed inside of unbraced box cofferdams. The work, which was interrupted last winter by cold weather, was resumed in the spring and is to be completed this season. The canal, however, was practically finished during the fall of 1915 by two dragline excavators equipped with 2½-yd. buckets. These machines worked 22 hours a day until stopped by frost, with 800 ft. of canal remaining to be constructed next the power house.

The work is being completed by the Central Power Company.

Manure Protects Concrete in Cold Weather

Manure as an effective protection for freshly made concrete during freezing weather has been the subject of experiment at the Lewis Institute in Chicago. Concrete slabs were exposed to outdoor conditions and covered with 2, 4 and 6 in. of fresh livery-stable manure. It was determined that the 4 and 6-in. layers were sufficient to protect the concrete against a drop in temperature of 25 or 26 deg. There was no indication that there was any advantage of the 6-in. covering over the 4-in. layer. The 4-in. layer appeared to be a sufficient protection against a temperature of 12 deg. Fahr. The manure and the liquids should not be permitted to come in direct contact with the freshly made concrete. This can be easily and cheaply accomplished by the insertion of building paper, or even newspaper, between the concrete and the protective covering.

To Facilitate Laying Out Sharp Railroad Curves

Tables Permit Determining Corrections for All Lengths of Subchords for Curves Ranging in Degree from 4 to 56

By F. T. HOWES
Valuation Department, Duluth, South Shore & Atlantic Railway, Duluth, Minn.

When sharp railroad curves are run in the field by the method of deflection angles, with chord lengths or subchords of less than 100 ft., a correction should, as is well known, be added to the subchord, for the reason that the degree of the curve is by definition the angle subtended by a 100-ft. chord, the arc is longer than the chord and the shorter the subchords the more closely they approximate the length of the arc. On curves of 10 deg. or sharper the correction is of appreciable moment. The accompanying tables have therefore been developed to facilitate the laying out of such curves.

In Table 1 will be found the lengths of seven convenient subchords for curves of every degree from 4 to 56. This table also gives the radius, the deflection angle for 1 ft. and the actual arc per station, as determined by the formula $A = (10/36)/(\pi D/\sin \frac{1}{2} D)$, where A is the length of the arc in feet and D is the degree of curvature.

Table 2—Ratio of Correction of Subchord to Excess of Arc per Station

Nominal length	Ratio	Nominal length	Ratio	Nominal length	Ratio	Nominal length	Ratio
1	0.010	26	0.242	51	0.377	76	0.320
2	0.020	27	0.250	52	0.380	77	0.312
3	0.030	28	0.258	53	0.381	78	0.304
4	0.040	29	0.266	54	0.382	79	0.296
5	0.050	30	0.273	55	0.383	80	0.287
6	0.060	31	0.280	56	0.383	81	0.278
7	0.070	32	0.287	57	0.384	82	0.268
8	0.080	33	0.294	58	0.384	83	0.258
9	0.089	34	0.301	59	0.384	84	0.247
10	0.099	35	0.307	60	0.383	85	0.235
11	0.109	36	0.313	61	0.383	86	0.224
12	0.118	37	0.319	62	0.381	87	0.211
13	0.128	38	0.325	63	0.379	88	0.198
14	0.139	39	0.331	64	0.377	89	0.185
15	0.147	40	0.336	65	0.374	90	0.170
16	0.155	41	0.341	66	0.372	91	0.155
17	0.165	42	0.346	67	0.368	92	0.141
18	0.174	43	0.350	68	0.365	93	0.125
19	0.183	44	0.354	69	0.361	94	0.109
20	0.192	45	0.358	70	0.356	95	0.092
21	0.201	46	0.362	71	0.352	96	0.075
22	0.209	47	0.365	72	0.345	97	0.057
23	0.218	48	0.369	73	0.340	98	0.039
24	0.226	49	0.372	74	0.334	99	0.020
25	0.234	50	0.374	75	0.327	100	0.000

Given a 20-deg. curve, and a desired chord length of 30 ft. From Table 1 the true chord length will be 30.14 ft., and there will be three chords of 30.14 ft. and one of 10.05 ft. for every 100-ft. station. From the table, the deflection for 1 ft. is 0° 06.0′. Hence the deflection for 30 ft. (nominal length) is 30 × 0° 06.0′ = 3°; the deflection for 10 ft. is 10 × 0° 06.0′ is 1°, and the total deflection per station is 10°.

Now it is found that whatever the degree of curve there is a constant ratio between the correction of subchord length and the excess of arc per station—actual length of arc minus 100. These ratios are given in Table 2 for chord lengths for each foot from 1 to 100. Using the two tables we can determine the chord lengths and deflections for nominal lengths other than those given in Table 1.

For example, given a 20-deg. curve and a proposed chord length of 22 ft. From Table 1 the excess of arc is 0.510 ft., and from Table 2 the ratio of correction is 0.209. Hence the correction for the subchord is 0.510 × 0.209 = 0.107 ft. and the subchord length is 22.107 ft. From Table 1 the deflection for 22 ft. is 22 × 0°06′ = 2°12′.

Table 1—Radii, Actual Arcs, Unit Deflections and True Chord Lengths for Various Nominal Chord Lengths and Degrees of Curve

Degree of curve	Radius, ft.	Actual arc per station	Deflection for 1 ft.	Nominal length of subchord: 10	20	25	30	40	50	55
				True length of subchord						
4	1432.69	100.020	0°01.2′	10.00	20.00	25.00	30.01	40.01	50.01	55.01
5	1146.28	100.032	01.5′	10.00	20.01	25.01	30.01	40.01	50.01	55.01
6	955.37	100.046	01.8′	10.00	20.01	25.01	30.01	40.02	50.02	55.02
7	819.02	100.062	02.1′	10.01	20.01	25.01	30.01	40.02	50.02	55.02
8	716.78	100.081	02.4′	10.01	20.02	25.02	30.02	40.03	50.03	55.03
9	637.28	100.103	02.7′	10.01	20.02	25.02	30.03	40.03	50.04	55.04
10	573.69	100.127	03.0′	10.01	20.02	25.03	30.03	40.04	50.05	55.05
11	521.67	100.154	03.3′	10.02	20.03	25.04	30.04	40.05	50.06	55.06
11°28′	500.51	100.167	03.4′	10.02	20.03	25.04	30.04	40.05	50.06	55.06
12	478.34	100.183	03.6′	10.02	20.04	25.04	30.05	40.06	50.07	55.07
13	441.68	100.215	03.9′	10.02	20.04	25.05	30.06	40.07	50.08	55.08
14	410.28	100.249	04.2′	10.02	20.05	25.06	30.07	40.08	50.09	55.09
14°22′	399.86	100.262	04.3′	10.02	20.05	25.06	30.07	40.09	50.10	55.10
15	383.07	100.286	04.5′	10.03	20.05	25.07	30.08	40.10	50.11	55.11
16	359.27	100.326	04.8′	10.03	20.06	25.08	30.09	40.11	50.12	55.12
17	338.27	100.368	05.1′	10.04	20.07	25.09	30.10	40.12	50.14	55.14
18	319.62	100.412	05.4′	10.04	20.08	25.10	30.11	40.14	50.15	55.16
19	302.94	100.460	05.7′	10.05	20.09	25.11	30.13	40.15	50.17	55.18
19°12′	299.82	100.470	05.8′	10.05	20.09	25.11	30.13	40.15	50.18	55.19
20	287.94	100.510	06.0′	10.05	20.10	25.12	30.14	40.17	50.19	55.20
21	274.37	100.562	06.3′	10.06	20.11	25.13	30.15	40.19	50.21	55.22
22	262.04	100.617	06.6′	10.06	20.12	25.14	30.17	40.21	50.23	55.24
23	250.79	100.675	06.9′	10.07	20.13	25.16	30.18	40.23	50.25	55.26
24	240.49	100.735	07.2′	10.07	20.14	25.17	30.20	40.25	50.28	55.28
25	231.01	100.798	07.5′	10.08	20.15	25.19	30.22	40.27	50.30	55.31
26	222.27	100.863	07.8′	10.09	20.17	25.20	30.24	40.29	50.32	55.33
27	214.18	100.931	08.1′	10.09	20.18	25.22	30.25	40.31	50.35	55.35
28	206.68	101.002	0°08.4′	10.10	20.19	25.23	30.27	40.34	50.38	55.38
29	199.70	101.075	0°08.7′	10.11	20.21	25.25	30.29	40.36	50.40	55.41
30	193.19	101.152	09.0′	10.11	20.22	25.27	30.31	40.39	50.43	55.43
31	187.10	101.230	09.3′	10.12	20.24	25.29	30.34	40.42	50.46	55.46
32	181.40	101.312	09.6′	10.13	20.25	25.31	30.36	40.44	50.49	55.49
33	176.05	101.369	09.9′	10.14	20.27	25.33	30.38	40.47	50.52	55.53
34	171.02	101.482	10.2′	10.15	20.29	25.35	30.41	40.50	50.56	55.57
35	166.28	101.572	10.5′	10.16	20.30	25.37	30.43	40.53	50.59	55.60
36	161.80	101.664	10.8′	10.16	20.32	25.39	30.45	40.56	50.62	55.64
37	157.58	101.759	11.1′	10.17	20.34	25.41	30.48	30.59	50.66	55.67
38	153.58	101.857	11.4′	10.18	20.36	25.43	30.50	40.62	50.70	55.71
39	149.79	101.957	11.7′	10.19	20.38	25.46	30.53	40.66	50.73	55.75
40	146.90	102.060	12.0′	10.20	20.40	25.48	30.56	40.69	50.77	55.79
41	142.77	102.166	12.3′	10.21	20.42	25.51	30.59	40.73	50.81	55.83
42	139.52	102.275	12.6′	10.23	20.44	25.53	30.62	40.77	50.85	55.87
43	136.43	102.386	12.9′	10.24	20.46	25.56	30.65	40.81	50.89	55.91
44	133.47	102.500	13.2′	10.25	20.48	25.59	30.68	40.85	50.94	55.96
45	130.65	102.617	13.5′	10.26	20.50	25.61	30.71	40.88	50.98	56.00
46	127.97	102.737	13.8′	10.27	20.53	25.64	30.75	40.92	51.02	56.04
47	125.39	102.860	14.1′	10.28	20.55	25.67	30.78	40.96	51.07	56.09
48	122.93	102.985	14.4′	10.30	20.57	25.70	30.81	41.00	51.12	56.14
49	120.57	103.114	14.7′	10.31	20.60	25.73	30.85	41.05	51.17	56.19
50	118.31	103.245	15.0′	10.32	20.62	25.76	30.89	41.09	51.21	56.24
51	116.14	103.38	15.3′	10.33	20.65	25.79	30.92	41.13	51.26	56.29
52	114.03	103.51	15.6′	10.35	20.67	25.83	30.96	41.18	51.32	56.34
53	112.06	103.65	15.9′	10.36	20.70	25.86	31.00	41.23	51.37	56.40
54	110.13	103.80	16.2′	10.38	20.73	25.89	31.04	41.27	51.42	56.45
55	108.28	103.94	16.5′	10.39	20.76	25.92	31.08	41.32	51.48	56.51
56	106.50	104.09	0°16.8′	10.41	20.79	25.96	31.12	41.37	51.53	56.56

Build Concrete-Slab Cover for 19-Mile Ditch

Earth Cushion Protects Concrete from Falling Boulders—Work Done by San Diego as Result of Flood Last January

By A. C. FRANCIS
Operating Department, San Diego, Cal.

The city of San Diego, Cal., recently completed repairs to the Dulzura conduit, a 19-mile open concrete ditch between the Morena reservoir and the Otay watersheds, at a cost of $13,290. The work, made necessary by the flood of last January, consisted of removing sand and other débris from such portions of the ditch as remained intact and the replacing of such concrete sections as had been washed out. Reconstruction of the wooden and steel flumes which had been torn away by landslides was also necessary. To prevent the entrance of dirt and débris into the open ditch, concrete slab covers were added, on which an earth cushion was placed to deaden shocks caused by falling rock.

Work was begun early in March and com-

CONCRETE SLABS PREVENT LANDSLIDES FROM FILLING OPEN DITCH

pleted the last of August. In the repair of the conduit, 20,315 yd. of earth and débris was removed, 1511 ft. of ditch was entirely replaced, 1196 ft. relined, 789 ft. of wooden flume rebuilt, and 695 ft. of steel flume renewed. Excavation cost $16,541; concrete work, $9,929; and flume repair, $14,139. Miscellaneous expenses amounted to $2,118. Nearly 1000 tons of supplies and material was hauled by auto truck from San Diego to Barrett, a distance of 40 miles, at an average cost of $8.50 per ton.

SLABS PLACED OVER OPEN DITCH

Upon completion of the repair job it was decided to place protecting slabs over portions of the open ditch where it was exposed to landslides. This concrete cover is from 6 to 7½ ft. wide and about 5 in. thick. Slabs were made by placing 8 and 25-lb. rails at intervals of 2 ft. and covering with wire mesh and concrete. At the end of each section of slabbing a small concrete wing wall prevents earth and other material on top of the slabs from falling into the ditch.

The concrete slabs are protected from falling boulders by an earth cushion several feet thick and sloping to conform somewhat to the grade of the mountainside. More than 1200 cu. yd. of earth was used in that way at a cost of 25 cents a yard.

About 3700 ft. of slab was built, at a total cost of $13,290.60. The cost per linear foot, including the wing walls and cushioning, was $3.614. This work was discontinued about the middle of October, but it is hoped that the remaining 2000 ft. of exposed conduit will be covered early next year.

Exposition Timber for Tunnel Lining

In timbering the Twin Peaks tunnel at San Francisco preparatory to pouring the concrete lining, about 19,000,000 ft. b.m. of lumber is being used. A large part of this was purchased by the contractors from the exposition company. The 12 x 12-in. timbers used in the columns of the various palaces were found to be about the size desired and for tunnel timbers they served as well as would the more costly lumber direct from the mill.

Light Timber Mast Used in Repairing Bascule Bridge

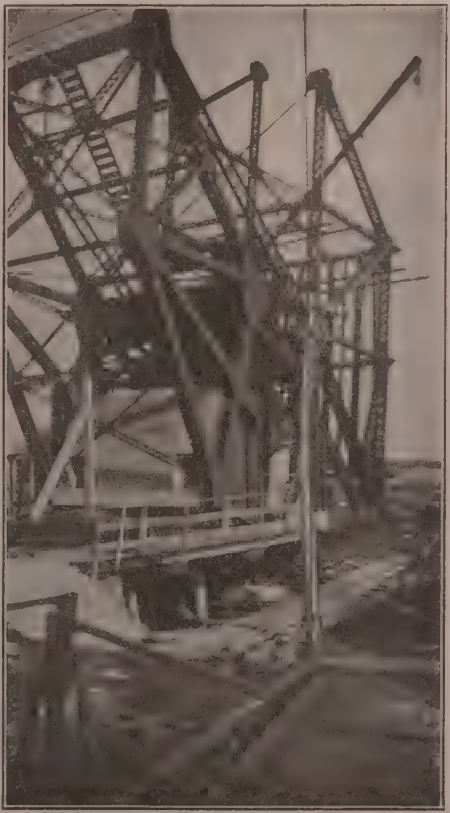
Damaged Moving Leaf Dismantled and Members Either Replaced by New Material or Straightened and Again Used

REPAIRS were completed and the damaged Strauss bascule bridge over the Sabine Neches Canal at Port Arthur, Tex., described in the Engineering Record of Aug. 19, page 228, was successfully restored to operating condition on Nov. 9. The moving leaf of this bridge was badly injured and bent when it was struck last April by a seagoing gasoline steamer. Soon after the accident a contract was let for its repair, and the dismantling and replacement have been successfully completed. A light timber mast was used in the erection work. It was connected to a heavy short timber by a double knuckle to allow movement in two directions, and could easily be attached to the steel frame of the bridge at any desired location.

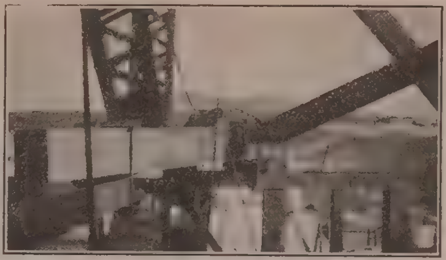
As described in the article mentioned, the span was in raised position at the time of the accident. Bracing timbers were at once placed to strengthen the moving leaf, the span was guyed with cables, the wooden floor was removed to lessen danger from winds and the counterweight was blocked against movement. The counterweight trusses and links suffered no damage.

DISMANTLING THE SPAN

The moving leaf was taken down member by member. Pieces that were slightly bent were straightened and used again. Those members that were too badly injured were replaced by new members. None of the machinery was damaged and the structural members supporting it were only slightly bent. Whatever machinery had to be moved to allow of repairs to structural members was not taken down entirely, but was lashed to the counterweight tower.



RE-ERECTION BY TIMBER MAST



DETAILS AT BASE OF MAST

The contractor's plant consisted of an air compressor to furnish the air used in cutting out rivets in dismantling and for driving rivets in re-erection, a hoisting engine placed on the ground to furnish power for handling the bridge members, and a timber mast fitted at its base with a double knuckle made up of steel plates and steel pins to permit movement in two directions at right angles. This mast was used in connection with the hoisting engine.

DETAILS OF MAST

The base piece of the mast was bolted to a short piece of timber which could be bolted to the span. These details are shown in one of the photographs. The mast was bolted to the span successively in several positions as the work progressed. Load lines for handling the steel and lines for swinging the end of the mast led to the hoisting engine on the shore. In dismantling, the mast was set and lashed to the span in position to reach the upper end, and as the members were taken down the mast was lowered to new positions as needed. In re-erecting the mast was of course raised each time.

Close to the bridge a forge was installed to heat members which were only slightly bent, and were straightened, a small derrick being used to handle the steel.

Evidence indicated that when the boat struck the bridge the piers were racked. One of the piers was cracked and one of the bottom laterals between the river piers and tower piers was broken. However, no attempt was made to straighten the piers. As a safeguard against a repetition of the accident, the city of Port Arthur has had several clusters of piles driven in addition to those originally put in when the bridge was erected.

The repair contract for the reconstruction of damaged parts was let to the Spence-Howe Construction Company, of Port Arthur, Tex. E. B. Van de Greyn of Houston, Tex., was retained as consulting engineer by the city and the contractors. The new steel members were fabricated by the Houston Structural Steel Company, of Houston, Tex.

Water in Earth's Crust

The amount of water contained in the earth's crust (to a depth of 3 miles) has been estimated by different writers with widely different results. A recent estimate is given by the U. S. Geological Survey of the total amount of free water in the earth's crust as equivalent to a uniform sheet over the entire surface of the earth having a depth of about 100 ft. This is only a small fraction of the estimate made by other writers.

HINTS FOR THE CONTRACTOR

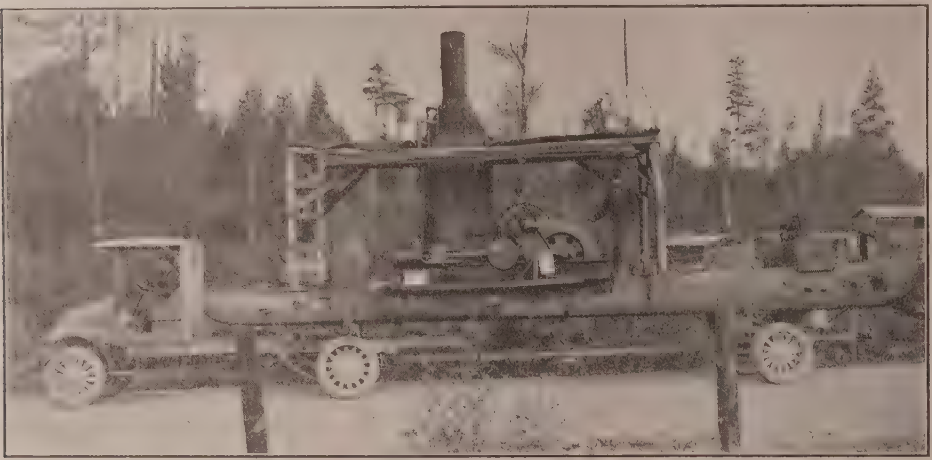
Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

Contributions to this section are solicited, and if found available will be paid for. They must be SHORT, *and should be accompanied, if possible, by photographs or sketches.*

Truck Used as Tractor Hauls Engine on Semi-Trailer

A DONKEY engine with its equipment, weighing about 13 tons, was recently transported by using two logs as supports and mounting them on a semi-trailer as shown in the accompanying picture. The logs weighed about a ton apiece, making the total load approximately 15 tons. The outfit was used near Seattle, Wash. The truck was a 3½-ton Kelly Springfield.



THREE-AND-ONE-HALF-TON TRUCK HAULS DONKEY ENGINE MOUNTED ON SEMI-TRAILER

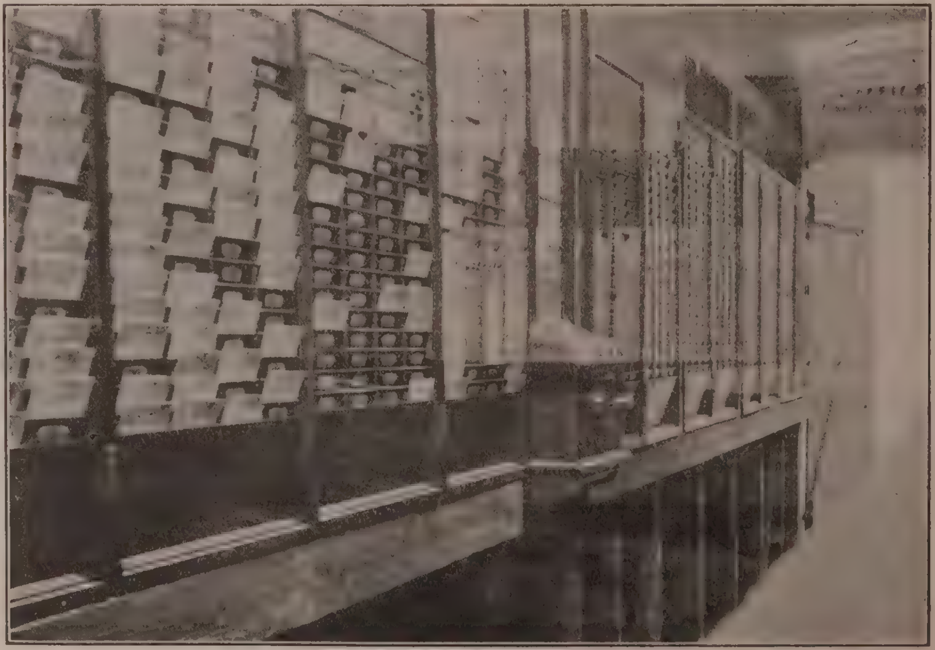
Time Clock Saves Office Work on Large Job

AN UNUSUAL office system for keeping time, checking tools and making distributions, in use on the construction work of the H. Koppers Company, is described on page 703 of this issue. It involves the use of a time clock, turning in of the distributions by the general foremen, and the issuing of from four to six tool checks to each man, and is said to save much office work and to give accurate results.

The men on going to work and leaving punch a slip in a time clock at the office. These slips are checked up by the timekeeper, who covers the job once during the day and sees that every man who has punched the clock is at work. From these slips the time is entered daily on the payroll. This timekeeper does not bother with the distribution of the labor, which is turned in each night by the general foremen. Each sub-foreman is supplied with small sheets on which he writes the names and numbers of the men in his gang and a description of the work he did during the day. This takes only a short time. These slips are turned in to the general foremen before leaving, who in turn hand them to the office force. From these slips, using the proper distribution numbers, two men in the office compile the labor charges and check the payroll.

This system simplifies the task of the timekeeper, who has only to check the time worked by the men, and also the task of the foremen, each of whom has only to put down the names of men in his gang and furnish a short description of the work done. With all the information on the desk in front of him, it is then an easy task for an office man to make the distributions and check them with the time worked. In this way three office men keep a close check on the doings of 450 workmen at a cost which ordinarily would permit of keeping only a general distribution of the time worked on different classes of construction.

Another good feature of the system is the method of checking the issuing of hand tools to the men. Each man, depending on whether he is a laborer or a mechanic, is given from four to six brass checks, each with his number on it. When he takes a shovel or a wrench from the tool house he gives up one of these checks. On a large rack on one side of the tool house are several hundred hooks, under each of a certain number of which is printed the word "Shovel," while other hooks are labeled "Pick," "Wrench," "Hammer," etc. The man's check is hung on one of the hooks labeled with the name of the tool he has taken. When he returns the tool his check is given back to him. Before pay day, or when a man is discharged, if he cannot show all the checks issued to him the storekeeper can tell in a few seconds whether he has any tools unreturned and what they are. He can also tell at a glance how many tools of any kind are out and who borrowed them.



WITH TIME CLOCK THREE OFFICE MEN KEEP CLOSE CHECK ON DOINGS OF 450 WORKMEN

Forms for Highway Arch Over Busy Railroad Hung from Girders

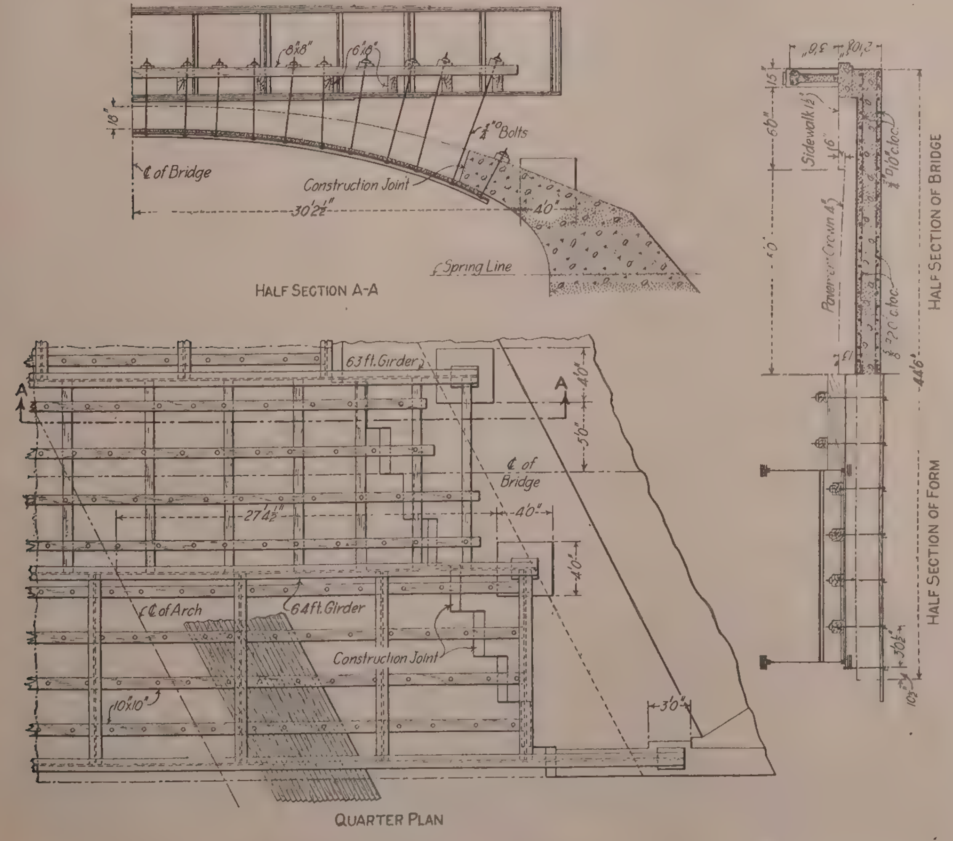
HAVING designed a concrete arch bridge for a highway crossing over its tracks at Millburn, N. J., with minimum clearance in order to reduce approach grades, the Delaware, Lackawanna & Western Railroad has constructed it by supporting the formwork from old plate girders. All three of the main line tracks below the bridge carry a heavy commuting traffic at certain hours of the day, and it was not advisable to erect any posts between the tracks. The bridge is on a skew and the main line below it on a curve at this point. The clearance allowed made ordinary arch centers out of the question.

The abandoned 60-ft. plate girder bridge which was used to support this centering was not quite long enough to span the entire distance. On this account the abutments and the lower section of the arch on each side were concreted together, the

WHERE CLEARANCE FORBADE SUPPORT FROM BELOW, GIRDERS OF OLD BRIDGE SET ABOVE ARCH CARRIED FORMS OVER 45-FOOT SPAN

arch sections being stepped back on planes normal to the thrust on account of the skew. This overhang was supported on the falsework shown in one of the illustrations. The girders were then set on the shoulders on blocking high enough to clear the concrete at the center of the arch, but, as it proved later, not quite high enough for convenience in pouring the last of the concrete. Between the outside pairs of girders the form was hung from timbers resting on the old floorbeams, while in the center space the timbers parallel to the girders rested on cross-timbers carried by the lower flanges of the girders. In each case bolts with nuts and beveled wood washers at the top end were run radially through the longitudinal timbers to support 3 x 3-in. angles bent to the curve of the arch on which transverse wood lagging was laid. The proper curve in the form was secured by screwing up the nuts at the upper ends of the rods supporting the angles.

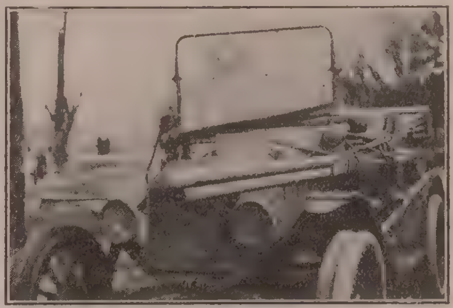
The bridge was built for the Delaware, Lackawanna & Western Railroad, of which George J. Ray is chief engineer, by James A. Hart, contractor, of New York City. The work was designed by A. B. Cohen, concrete engineer for the railroad, and was in charge of G. B. Barackman, assistant engineer, and G. T. Hand, division engineer.



SUPPORT OF ARCH FORM COULD EASILY BE PLACED AND QUICKLY ADJUSTED

Extra Outside Rims Help Surface Car Over Muddy Roads

THE EXTRA rims bolted to the Ford automobile shown in the photograph are equipped with undersize tires which come to a bearing on muddy roads and greatly increase the traction. According to A. E. Wishan, who described the device in *Wrinkles*, a publication of the Pacific Coast Gas Association, it proved a life saver during recent floods in one of the gas-oil fields of California. The application of this rig to the bad roads met with in the neighborhood of many contract jobs is obvious. The extra rims are bolted by means of small angle irons to each spoke of the regular wheels. The extra tires are one size smaller than those on the main wheels, so that when the car is traveling on hard roads the load is carried as usual on the main tires. When the car hits a muddy stretch, however, the extra tires come to a bearing and a great amount of traction surface is added, enabling the car to pull through heavy mud with comparative ease.



REGULAR RIM CARRIES LOAD ON FIRM GROUND

Short Pieces of Steel Sheeting Used by Welding Together

HAVING on hand some short pieces of Lackawanna steel sheeting and having use for longer piles, the contractor for the $1,000,000 addition to the Omaha Electric Light & Power Company's plant has made use of the short pieces by welding two of them together at the ends.

The two pieces to be joined are laid end to end on blocking, and the welding done with an oxyacetylene torch. It is said that the welded piles have proved entirely satisfactory. The welds are made by one man in about one hour each.

The addition to the plant is being built by the Phoenix Construction Company of Omaha.

Drum on Rear Axle of Concrete Mixer Pulls Template

By HARLAN H. EDWARDS
Urbana, Illinois

A DRUM PLACED on the rear axle of a concrete mixer is proving very convenient and effective for drawing forward the template on monolithic brick-pavement construction. The mixer shown in the photograph is a Chain Belt, used by the McCalman Construction Company near George-

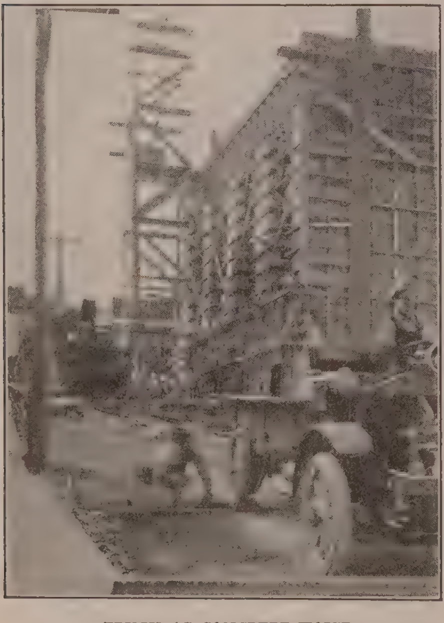
STEADY HORIZONTAL PULL OF LOW-SET DRUM ON TEMPLATE GIVES SMOOTH SURFACE

town, Vermilion County, Ill. The drum is operated independently of the forward motion of the mixer by a lever placed at the side of the operator and connected to a clutch on the rear axle. By the use of this drum a low, horizontal and steady pull is exerted upon the template, making a smoother surface upon which to lay the brick than that obtained when the template is pulled forward by the jerky, uneven motion of the mixer as it moves ahead. Besides its convenience for this purpose, such a drum is useful to the contractor for hoisting where a larger and separate hoisting engine is not required.

Motor Truck Hoists Concrete

By EDMUND G. KINYON
Grass Valley, Cal.

HAVING an extra motor truck handy and wishing to avoid paying freight on a hoisting engine from the city in which his headquarters were located, the contractor for a reinforced-concrete bank building in Grass Valley, Cal., successfully substituted the truck for a hoist. The line from the cage was run through a sheave at the foot of the car and fastened to the truck, which ran back and forth a short distance on the side street where the concrete plant was located. Heavy timbers laid across the road marked the starting and stopping points for the driver. Besides this man, a laborer was used to block the wheels at the end of the run.



TRUCK AS CONCRETE HOIST

Chute Carried by Derrick Easily Shifted in Five Minutes

By CAPT. A. H. ACHER
Corps of Engineers, U. S. Army,
San Pedro, Cal.

A LARGE stiffleg derrick is being used by the writer to support the chutes for placing 14,000 yd. of concrete in emplacements for a big battery at Fort MacArthur, and has reduced to a very low point the time and labor required for shifting the chute line. As may be gathered from the photograph, the remainder of the 18,000 yd. to be placed by this plant will be delivered through a higher chute line leading from the upper platform.

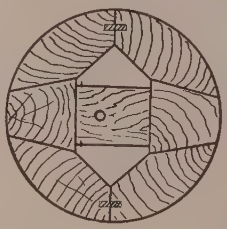
The tower is 133 ft. high, and the lower line from the derrick mast outward has a length of 125 feet. The line swings on this radius through an arc of 270 deg., and the counterweighted chute pivoted at the end of the boom permits it to reach any point within this circumference. The chute has a 40-per cent fall in this length of 125 feet. It requires only 5 minutes to shift the end of the line to any point within reach of the rig.

The concrete work, which covers a total area of 150 x 500 ft., was charted and laid out to be poured in 60 working days of eight hours each. Construction was begun on Nov. 10 last, and is being carried on by the writer as construction officer under Major G. B. Pillsbury, district engineer officer, with G. A. Barcroft as superintendent and C. J. Fischer as overseer.

CHUTES SUPPORTED BY DERRICK TO POUR 14,000 YARDS AT LOW COST FOR SHIFTING

Form for Ventilating Ducts Collapsed by Pulling Cord

SIX VERTICAL pieces of wood fitted together as shown in the sketch and held at intervals by spreaders placed in the center as indicated were used by the Turner Construction Company to form ventilating flues in building a manufacturing plant at Hoboken, N. J. These flues, which will be used to carry away waste gases generated by small furnaces, are 8 in. in diameter and are grouped around the elevator shafts. The forms, as described in a recent issue of *Concrete*, were assembled and wired together to set in place while pouring was under way. The spreaders in each form were roped together, the holes through which the rope passed being off center so that the blocks would come out quickly when the rope was pulled. After the concrete had set and the spreaders had been removed, the other pieces were easily loosened with a bar and taken out by hand.



NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Propose $260,000,000 Program for Chicago Transit

Subway Commission Includes Eleven Miles of Subway in Recommendations Requiring $60,000,000 in Next Three Years

Eleven single-track miles of double-track subway, 64 miles of new elevated lines and 150 miles of new surface lines are recommended by the Chicago Traction and Subway Commission as the first steps in the solution of Chicago's transit problem. The full report of the commission, which consists of William Barclay Parsons, Robert Ridgway and Bion J. Arnold, is not yet available—in fact, the main features are made known at this time only because a Chicago daily newspaper in some way obtained possession of and published a part of the report early this week. Approximately $100,000,000 is the estimated expenditure necessary by 1926 to give Chicago satisfactory transit facilities. Three three-year construction periods are recommended, and the program for the first calls for an expenditure of $60,553,000. The ultimate investment, to carry out the plans of the commission through the year 1950, is placed at at least $260,000,000.

The general plan aims to provide main rapid-transit lines that will serve all parts of the city and carry people to and from all the business districts; to provide through routes outside the loop district; to provide better means of travel through the central district, and to relieve surface congestion wherever necessary. Unified operation of all Chicago's local transportation facilities is recommended, with the control vested in the city council, but with a board of supervision and control given the broadest administrative powers.

Two Subways Recommended

For the first three-year period the beginnings of two subway systems are recommended, one for the elevated systems and one for surface cars. The former is for the purpose of separating the north and south from the east and west loop traffic. It is proposed to separate the grades of the north and south and east and west elevated lines in Fifth Avenue, and carry the Northwestern-South Side traffic on an extension of the Fifth Avenue line south to Polk Street and east to the South Side Elevated. Thus the Metropolitan and Lake Street lines would have the exclusive use of the north, east and south sides of the loop. Further relief for the Northwestern-South Side line, and a direct route through the heart of the loop, would be afforded by a double-track subway to be built in State Street from Eighteenth Street to Chicago Avenue. This subway would cost $10,350,000, it is estimated.

The other subway, for surface cars, would be a loop under Jackson and Washington Streets and Michigan Boulevard. Its estimated cost is $7,181,750.

These subways and the elevated extension in Fifth Avenue and Polk Street are only part of the program for the first three-year period, which embraces twenty-three items of line extensions, connections, additional tracks, rolling stock and the like. The ultimate, $260,000,000 plan provides for 58.1 miles of subway, of which 53 miles are for rapid transit.

Concrete Pipe Association to Meet in Chicago in February

The annual convention of the American Concrete Pipe Association will be held Feb. 12, 13, and 14, in Chicago. As the meeting comes during the second week of the Cement Show, opportunity is afforded for a big attendance.

City Engineering Employees Ask Increase in Salary

Present Petition to Chicago Council—Cite High Cost of Living and Increases in Labor Wage as Reasons for Demand

Basing their arguments on the fact that in 1910 their salaries were fixed after exhaustive study, that the cost of the necessities has risen 50 per cent since then, and that compensation that was fair under past conditions cannot be so considered under present changed conditions, the engineers employed by the city of Chicago have presented a petition to the mayor for substantial increases in their salaries. It is shown that the salaries of the employees in the city engineering service have been practically unchanged for twenty years. During that period men engaged in other lines of work coming under the direction of the engineering service have had frequent increases in compensation. A list of companies which have voluntarily increased the salaries of their employees is also printed as proof of the necessity for better compensation.

Increase in Labor Wage

In Exhibit B of the petition it is shown that the pay of the average foreman has increased from 1897 to 1916 approximately 51 per cent; that average skilled labor has had an increase of 83 per cent, and average common labor, 220 per cent. The foreman who received $112.50 a month in 1897 is now paid $170.25; average skilled labor received $86.78 in 1897, while now $158.83 is the figure. Average common labor has increased from $39.58 to $126.67 in the same period.

The petitioners believe that "when engineers who are in charge of work and responsible for its proper execution are paid less than the foreman and some of the mechanics working under their direction, neither can attain the highest efficiency. A corps of men feeling themselves underpaid as compared with other employees cannot, in spite of the best intentions on their part, render the service which will result in the most economical expenditure of the city's funds."

It is proposed by the engineers that a $30 per month increase be granted to those now receiving $90 to $125 a month, and a $40 increase to those now being paid $135 to $200 a month.

Committee Will Study Conservation of Water in Pennsylvania

A committee to study water conservation throughout Pennsylvania and to draft legislation to be presented to the 1917 session of the general assembly of the state was recently appointed by Dr. Samuel G. Dixon, state health commissioner, who was chairman of a conference on the subject held recently at Harrisburg.

Doctor Dixon will act as chairman of the permanent committee, whose members are Gifford Pinchot, president of the National Conservation Association; Dr. Henry S. Drinker president of Lehigh University; William H. Keller, deputy attorney general; John B. Eichenauer, member of the Pittsburgh Flood Commission; George S. Webster, director of the Department of Wharves, Docks and Ferries, Philadelphia; Prof. Edgar Marburg, of the University of Pennsylvania; S. B. Elliott member of the Pennsylvania Forestry Commission, and J. A. Wells, vice-president and chief engineer of the Pennsylvania Water & Power Company. The committee will be enlarged from time to time.

Plan $6,500,000 Reservoirs in Adirondacks

Glens Falls, N. Y., Applies for Formation of Upper Hudson Regulating District—Would Control Flow of Hudson River

Two great reservoirs in the Adirondack Mountains, costing about $6,500,000, are included in plans for the Upper Hudson River Regulating District presented last Monday to the Commission on River Regulaton at Albany, N. Y. The application was made by the Chamber of Commerce of Glens Falls, N. Y. It is intended that the cost of the project shall be paid by the municipalities or counties benefited.

Under the application it is proposed to construct a dam at Conklingville on the Sacandaga River that would form a lake 42 square miles in area, flooding 30,000 acres of land and parts of twelve villages. This would also require the relocation of 40 miles of highway and 8 miles of railroad. This reservoir would contain 20,000,000,000 cu. ft. of water.

Propose Dam on Schroon River

The second reservoir project is for a dam on the Schroon River at Tumblehead Falls, which would back up the water on the river and on Schroon, Brandt and Paradox lakes to a height varying from 20 to 30 ft., burying parts of the towns of Chestertown, Horicon, South Horicon and Pottersville and flooding 30 miles of highways. A lake would be formed 24½ square miles in area containing about 16,000,000,000 cu. ft. of water.

The Sacandaga project, the estimated cost of which is $4,661,000, is considered the more feasible. The water regulation it would afford in the Hudson River would increase the available horsepower at developed sites from 29,490 in the dry seasons to 131,697.

Most of the fifty persons present at the hearing seemed to be in favor of the project. The opposition was mostly because of the scenery that would be destroyed. After hearing preliminary arguments the commission adjourned the hearing to Jan. 30.

Affects Industries All Along Hudson

In presenting the project Elmer J. West, president of the Glens Falls Chamber of Commerce, said there were two main reasons why storage reservoirs should be built on the Sacandaga and Schroon rivers—the increase of power and the reduction of spring floods. The project is more than a local one, said Mr. West, and affects every manufacturing industry along the Hudson River from Corinth to tidewater.

D. F. Emery of Glens Falls said the water power had decreased for years at that point on account of the destruction of the forests on the upper Hudson watershed and the drain upon the river by the Glens Falls feeder, which takes water to the Champlain Barge Canal. To counteract these two influences, said Mr. Emery, storage reservoirs are necessary, not as an altruistic endeavor, but in the material interest of the people of Glens Falls and of those below.

Expected to Decrease Flood Damage

A. E. Roach, representing Troy, pointed out that the annual damage by floods at that point was from $250,000 to $300,000, while every five or six years it exceeds $500,000. The river-regulating project, said Mr. Roach, was expected to decrease this damage and also to increase the amount of power generated at the federal dam in Troy.

George Welwood Murray, representing the Schroon Lake Association, entered a strong protest against the creation of a storage reservoir in the valley of the Schroon River. The contemplated dam at Tumblehead Falls, he said, would entirely envelop not only Schroon, Paradox and Brandt Lakes, and wipe out the villages of Chestertown, Horicon, South Horicon and Pottersville, as stated in the petition, but would also submerge the village of Adirondack, a large part of the village of Schroon Lake, and all of Severance and Paradox villages. The entire Schroon Valley, said Mr. Murray, would be completely ruined as a vacation and health resort on account of the drawing down of the water during the dry seasons. He questioned the right of the power owners on the Hudson River to disturb the property rights of the people of the Schroon valley for the purpose of power production.

Adopt Automatic Schedule for American Society Conventions

The board of direction of the American Society of Civil Engineers, at its meeting of Oct. 10, considered and adopted a "method by which the annual convention would move automatically from one district to another in such sequence as would insure that all parts of the country are brought into closer touch with the society's work."

The rotation of districts in which conventions shall be held was adopted as follows:

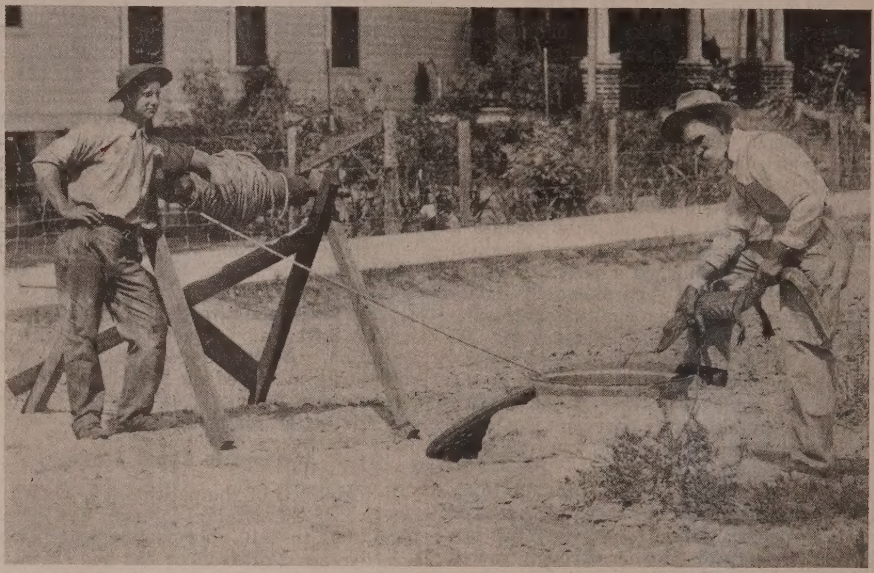
Year	District	Center of District
1917	7	Wisconsin
1918	11	New Mexico
1919	2	Maine
1920	12	Oregon
1921	5	Georgia
1922	10	South Dakota
1923	6	Ohio
1924	9	Arkansas
1925	3	Quebec
1926	8	Indiana
1927	13	Nevada
1928	4	Pennsylvania

A suggestion that a second meeting be held outside of New York City was also considered. The board is of the opinion that if such a meeting could be given a distinctly technical character and be designated as one of the business meetings provided for by the constitution it would result in centering activity in each district at least once in six, instead of twelve, years, as would otherwise be the case. The board, therefore, decided that the option of assuming responsibility for a second meeting in any year shall be offered to each district in turn, with the understanding that it can be accepted or declined.

Chicago Formally Opens Its Public-Utility Galleries

An initial section of utility galleries was formally opened Dec. 5 in Chicago. It is 1200 ft. long, and is located at Canal and Monroe Streets. Telegraph, water, electric light and power, pneumatic mail tubes, telephone and Sanitary District services are accommodated, and there is ample room for future expansion. The galleries were described in the Engineering Record of Nov. 13, 1915, page 593.

John Ericson, city engineer, as a member of the Commission on Downtown Municipal Improvements, with Alderman W. J. Healy as chairman, made the first suggestion that a gallery be considered in connection with the construction of the new Union Station, although the district was outside that which the commission had under consideration. The commission took the matter up seriously, and finally the city engineer was instructed to proceed with designs of the galleries. At the first consideration and layout of the project there were obtained the service and advice of Ray Palmer, former commissioner of gas and electricity; H. L. Dean, assistant engineer of that department; also H. S. Baker, assistant city engineer; and L. C. Dumond, secretary and engineer of the Commission on Downtown Municipal Improvements. Later the suggestions of the engineers of the various utility corporations, as regards many details, were obtained.



Alligator Used to Clean Clogged Sewers in Florida City

A 600-FOOT 12-INCH SEWER in Fort Meade, Fla., recently became clogged with sand and dirt. Several sewer-cleaning contrivances were used and about $1,500 was spent, but to no avail. The pipe remained in its unsatisfactory condition. Just when everyone had given up in despair, Ben R. King, superintendent of water and sewers, secured a small alligator, to which he fastened a rope. The animal, when lowered into the pipe, proceeded toward the next manhole, dragging the rope after him. When the alligator had traversed one section of the sewer, the rope, to the middle of which knotted chains were attached, was pulled back and forth and the obstructions removed. Mr. King now has ten alligators which he uses in sewer cleaning in Florida cities.

This information and the picture were supplied by George W. Simmons, Jr., sanitary engineer for the Florida State Board of Health, Jacksonville, Fla.

Recommends Two Municipal Piers for Camden, N. J.

The construction of two municipal piers at the foot of Spruce Street constitutes the first recommendation made to the city of Camden, N. J., by B. F. Cresson, Jr., chief engineer of the New Jersey Board of Commerce and Navigation, as the result of a study of how to develop Camden's possibilities as a port. Mr. Cresson proposes one pier about 600 ft. long and 326 ft. wide and another about equally long and 75 ft. wide. On the wider pier it is proposed to erect parallel three-story buildings so designed as to serve as both pier sheds and warehouses. Rail connections would reach both piers. The total estimated cost of the improvement is $881,473.

New England Waterworks Men Convene December 13 in Boston

The New England Waterworks Association will hold its December meeting next Wednesday at the Hotel Brunswick, Boston. The nature of color in water and waterworks in Cuba are the subjects of two papers to be presented by Thorndike Saville, of Cambridge, and Robert Spurr Weston, consulting engineer, of Boston.

To Reclaim Land in St. Louis

The City Plan Commission of St. Louis, Mo., in conjunction with four of the municipal departments, has just issued a report outlining a combined project of industrial development and flood relief from the River des Peres. In addition to a sewer and channel in the river valley it is suggested that a railroad be built to complete the belt line around the city and that a scenic driveway be constructed. The cost of the project is estimated at $8,000,000. The proposed work, the report points out, will make available for industrial and residential purposes extensive tracts of land now unfit for use because of floods and offensive conditions in the stream which drains this territory. Harland Bartholomew is engineer of the City Plan Commission.

Two Bids Received for Incinerating San Francisco Garbage

In response to the call of the city of San Francisco for proposals to dispose of the city's garbage, as announced in the Engineering Record of Nov. 11, two proposals were received by the board of supervisors on Nov. 20. Neither of the propositions contemplated the destruction of garbage by incineration, the method of disposal which it has been agreed would be the more satisfactory, but proposed that the refuse gathered from various sections of the city should be used to fill in low lands, which would be later converted into industrial sites.

The offers were from Richard Schmidt, who agreed to pay 20 cents a ton, and from A. B. Moffit and F. B. Smith, who offered to pay 22½ cents a ton.

Discuss Regulation of Traffic

The Washington State Good-Roads Association held its annual convention Nov. 16 and 17 at Centralia, Wash., with 130 delegates present. Several resolutions affecting traffic on highways were adopted and will be recommended to the state legislature.

Limiting the speed of motor trucks to 15 miles per hour, as well as regulating the loads, was discussed at length. Inspection by the highway department of all roads constructed, whether by the state, county or township, was also thought advisable. A uniform system of designating and marking state roads throughout the state, legislation providing that county engineers be appointed by county commissioners instead of being elected at large, and the standardization of speed, lighting and other requirements of automobiles came in for their share of attention. The installation of a uniform system of cost accounting for the construction and maintenance of all roads, whether by state, county, township or district, and including such cost figures in the biennial report of the state highway commission, was recommended.

Surveying for 35-Mile Ship Canal Along Sacramento River

The project for constructing a deep-water ship canal from Sacramento, Cal., to San Francisco Bay, as outlined on page 431 of the Engineering Record for Oct. 7, has taken definite shape to the extent that funds have been appropriated for the final survey of the proposed route. On Nov. 21 the Sacramento Chamber of Commerce announced that it had available $1,500 in cash and a promise of $2,000 more toward the work. According to an agreement with the state engineering department, these funds, raised by the city, will be increased by an equal amount of state funds, so that a total of $7,000 is now considered available.

The plan is to construct a channel for deep-water vessels which will be entirely separate from the main channel of the Sacramento River and thus free from silting, current and tidal effects. Of the total length of 35 miles, which is estimated by Major P. M. Norboe, assistant state engineer, as the length in which excavation will be necessary, 14 miles is in river channels already used for river craft. Only such excavation as will straighten bends and deepen the channel will be required. The remaining 21 miles will be in original excavation in earth, the surface of which varies from approximately 5 ft. below to 10 ft. above mean tide. Major Norboe has estimated that a canal with a minimum depth of 30 ft. can be excavated at a cost of about $1,000,000.

Annual Meeting of American Society January 17 and 18

The sixty-fourth annual meeting of the American Society of Civil Engineers will be held Jan. 17 and 18 at the house of the society in New York City. The business meeting will be called to order at 10 o'clock Wednesday morning. The annual reports will be read, officers for the ensuing year elected, members of the nominating committee appointed, reports of special committees presented, and other business transacted. Arrangements for excursions and entertainments will be announced later.

Special meetings of the society will be held Friday, Jan. 19, at which the business to be transacted will be limited to a discussion of the progress report of the special committee on materials for road construction.

Proposes Two Million Dollar Additions to Lockport Plant

Additions to the hydroelectric plant of the Sanitary District of Chicago at Lockport are recommended in an exhaustive 353-page report by Gardner S. Williams, consulting engineer, on "all facts and questions arising in connection with the cost and operation of the district's hydroelectric plant and electrical development." His suggested plan for increasing the gross income from $969,000 to $1,357,000 would increase the profits by $300,000, says Mr. Williams. A huge equalizing basin for the storage of water at Lockport is the plan. It would cost about $1,000,000 and the increase in power available would be sufficient, with an average flow of 10,000 cu. ft. per second, to increase the sale of current 40 per cent. Additional generating capacity would cost $900,000. He also suggests replacing the present generators with more modern equipment, thereby increasing the output 10 per cent.

Yes, He's German!

A correspondent comments upon the meetings of the New England and American Waterworks associations as follows: "Meeting at Portland, Me., dry; next one at Richmond, Va., dry. They even make us *drink* their water. That's what I call combining business with pleasure to the limit."

Office of Public Roads Appoints District Engineers

The U. S. Office of Public Roads and Rural Engineering has appointed the following engineers to take charge of the work in the districts named:

L. I. Hewes, District 1, comprising Washington, Oregon and Idaho; C. H. Sweetser, District 2, comprising California, Nevada, Arizona and New Mexico; J. A. Whittaker, District 3, comprising Montana, Wyoming, Utah and Colorado; E. O. Hathaway, District 4, comprising the Dakotas, Minnesota and Wisconsin; J. C. Wonders, District 5, composed of Nebraska, Iowa, Kansas and Missouri; J. D. Fauntleroy, District 6, made up of Arkansas, Louisiana, Oklahoma and Texas; J. T. Voshell, District 7, comprising Michigan, Illinois, Indiana and Kentucky.

J. T. Bullen will have District 8, which includes Florida, Georgia, Alabama, Mississippi, South Carolina and Tennessee; Guy H. Miller, District 9, composed of Connecticut, Delaware, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island and Vermont, and H. K. Bishop, District 10, Pennsylvania, Ohio, West Virginia, Virginia, Maryland and North Carolina.

Newlands Commission Cannot Complete Report by January 9

Coincident with the opening of Congress, and the unusual interest in possible railway legislation which is likely to prove the most important subject to be considered, it was announced that the Newlands joint commission, which is investigating the transportation problem, would not be able to make its report by Jan. 9, the date called for in the act creating the commission. It was suggested that the commission would ask for an extension of the time limit. The commission has had an opportunity thus far to examine only one witness, and the members feel that they cannot go into the problem before them as thoroughly as they wish in the time remaining.

Railway Maintenance Departments Want Eight-Hour Day Too

Declaring their work is "dirty, laborious and underpaid," 400,000 members of the maintenance departments of American railways filed a petition Dec. 4 with Congress asking to be included in "any eight-hour railroad legislation."

Southwestern Engineers to Organize

A. F. Barnes, dean of engineering of the New Mexico College of Agriculture and Mechanic Arts, is endeavoring to organize a Southwestern engineering society. Letters have been received from prominent engineers in New Mexico, Arizona and Texas expressing the need of such an organization. Among the men who have promised their support are Dean G. M. Butler, of the University of Arizona; Dean S. H. Worrell of the Texas School of Mines; Professor Brenneman of the University of New Mexico; Samuel I. Bousman, engineer for the Chino Copper Company, Hurley, N. M.; H. L. Stevens, consulting refrigeration engineer, El Paso, Tex.; E. H. Baldwin, project manager of the Elephant Butte Dam, and S. O. Andros, Albuquerque, N. M., chairman of the New Mexico State Directors, Naval Consulting Board.

The object of this organization will be to promote the science of engineering in the Southwest. The principal means for this purpose are to be meetings for the reading and discussion of professional papers, especially upon such questions as are peculiar to this region, and opportunity for special intercourse, thus establishing a common interest in the welfare of the engineering profession.

It is planned to call at an early date a meeting of those engineers that have shown interest in the matter. At such a time tentative plans and a program for a general meeting will be considered.

What Engineers and Contractors Are Doing

P. L. ECKERT, a prominent contractor of Wilkes-Barre, Pa., after thirty years of active construction work in the vicinity of that city, is removing his entire business to Detroit, Mich.

H. M. STICKER, a member of the highway engineering staff of the Portland Cement Association, is visiting Pennsylvania cities to make an extensive study of all types of concrete roads.

J. E. BRECKENRIDGE has been engaged as valuation expert by the board of city commissioners, Jersey City, N. J., to assist the city in its effort to secure increased valuations on local second-class railroad properties.

GRANT SMITH & COMPANY of St. Paul, maintaining contracting offices throughout the Northwest, recently opened a permanent office in the Multnomah Hotel, Portland, Ore.

GEORGE WATKINS EVANS, consulting mining engineer, of Seattle, has accepted an offer to become engineer in charge of the Northwest division of the U. S. Bureau of Mines, with headquarters at the newly established station at the University of Washington. Mr. Evans is well known in mining circles in the West and Northwest, having been engaged in several examinations for the government as well as for private enterprises. In 1915 he examined the Bering River coal fields in Alaska and subdivided that field into leasing units for the government. During the last summer he examined the Nenana coal fields in the interior of Alaska for private interests, and made a study of the fuel needs of the interior of Alaska. Dorsey A. Lyon, president of the Salt Lake mining and metallurgical testing station, will have charge of the Seattle station.

ARTHUR B. MURPHY, formerly assistant engineer in the office of the city engineer of Albany, N. Y., is now assistant engineer to the chief engineer of the Coventry Land & Improvement Company, of Akron, Ohio.

K. L. MINER, bridge inspector for the New York Central Railroad, has been transferred from the Adirondack division to the Ottawa division. As supervisor of bridges and buildings of the latter division he will have to do with strengthening bridges for heavier traffic. His office is at Ottawa, Ontario.

A. L. UPHAM, in the employ of the Portland Cement Association, has been transferred from work in Indiana to Pittsburgh, where he will manage the local office.

E. H. DAVIS has resigned as road supervisor and civil engineer of Spalding County, Georgia, to take a place as engineer for the state highway commission. It is expected that Mr. Davis will be employed on the Dixie Highway from Atlanta to Macon.

PELLISSIER & DIBBLE, engineers and architects, of Springfield, Mass., have removed their offices to the Third National Bank Building.

D. A. WALLACE has resigned as resident engineer of maintenance for the Canadian Pacific Railway to become associated with the Imperial Munitions Board at Ottawa.

C. E. EDWARDS, who has been in the employ of the U. S. Reclamation Service since 1910, was recently made superintendent of construction on the Yakima-Sunnyside project. Mr. Edwards joined the Reclamation Service as rodman immediately after graduation from the Ohio Northern University in 1910. He rose to the grade of engineer and general foreman in 1913, when he was on the Okanogan project in Washington. His latest promotion came when he was recently transferred to the Yakima-Sunnyside project.

William E. Wilbur has left the employ of Harrington, Howard & Ash, consulting engineers, of Kansas City, Mo., to become associated with Klyce & Kackley, civil and consulting engineers, of Miami, Fla. He is now working on the Miami causeway project and expects to be resident engineer in charge of inspection of the work. After graduation from the Iowa State College in 1911, Mr. Wilbur entered the employ of Waddell & Harrington, consulting engineers, of Kansas City, and remained with Mr. Harrington when the new firm of Harrington, Howard & Ash was formed.

Henry H. Damon, formerly assistant engineer with the New York Public Service Commission, First District, is now engineer in the Bureau of Yards and Docks, Washington, D. C. Mr. Damon is a graduate of Harvard University, class of 1906, as well as of the Massachusetts Institute of Technology, class of 1908. His first work after graduation was with the Charles River Basin Commission. That was followed in 1909 by his appointment as instructor in mathematics on the Massachusetts nautical training ship U. S. S. Ranger. Upon his return from a six-month cruise to European ports Mr. Damon went to the Philippine Islands as assistant engineer, Bureau of Public Works. After about three years he returned to the United States to take a position as structural designer for Stone & Webster on the new Massachusetts Institute of Technology buildings. His appointment as assistant engineer with the New York Public Service Commission came in 1915.

E. F. Reagan, who had charge of construction of the Dickson Trust Bank Building in Richmond, Ind., is now with the James Stewart Company, with headquarters in St. Louis. He will have charge of building additions to the Leschen Rope Company's plant. Mr. Reagan was graduated from Purdue University in 1907 and has been engaged in the construction of fireproof buildings since then.

Shirley C. Hulse, of Bedford, Pa., is at present with the Tallassee Power Company, Alcoa, Tenn.

Ernest McCullough, chief engineer of the fireproof construction bureau of the Portland Cement Association, has been appointed a member of the committee on fire-resistive construction of the National Fire Protection Association.

Lewis R. Ferguson, of the Portland Cement Association, is accompanying R. J. Wig, of the U. S. Bureau of Standards, on a trip along the Atlantic and Pacific coasts for the purpose of examining various concrete structures exposed to sea water.

W. S. Curtis, of San Francisco, has been appointed assistant engineer in the California State Department of Engineering. It is expected that his first work will be an investigation of the water supply of the state hospitals.

Allen Kisinger has resigned from the waterworks department of Cincinnati to become city engineer of Norwood, Ohio.

M. C. Selden, formerly division engineer of the Chesapeake & Ohio Railway, has been appointed trainmaster of the Rivanna division.

L. M. Brooks, formerly with Norton, Bird & Whitman, engineers, of Chicago and Baltimore, is now engineer of construction for the Electro-Mechanical Company of Baltimore.

Oliver C. Sheley was recently elected county engineer of Jackson County, Mo.

E. I. Davis, formerly with the U. S. Reclamation Service at Hermiston, Ore., has been appointed chief engineer of the Anderson-Cottonwood Irrigation District, California. He succeeds H. H. Henderson, who resigned recently. Thomas H. Means, of San Francisco, serves the district as consulting engineer.

J. W. Gwinn has been appointed president of the new county board of review of Jefferson County, Ala. The board supervises public work all over the county. Mr. Gwinn was formerly county engineer.

Arthur C. Eversham, who was appointed engineer of construction for the Kansas City Bridge Company in October, 1915, has resigned. He is now terminal engineer of the Union Pacific Railroad at Kansas City. Before going to the Kansas City Bridge Company, Mr. Eversham was assistant to the chief engineer of the Kansas City Terminal Railway. He was graduated from the University of Cincinnati in 1902. Among his more important work is that on the Detroit River tunnels for the Michigan Central Railroad from 1905 to 1909.

Edward M. Bigelow, who resigned as state highway commissioner of Pennsylvania in April, 1915, has been made director of the Department of Public Works of Pittsburgh, to succeed the late Robert Swan. Mr. Bigelow has been identified with the engineering department of Pittsburgh for many years and helped to make possible the construction of Grant Boulevard in that city.

Max L. Cunningham, consulting engineer, of Oklahoma City, has been appointed state engineer of Oklahoma. His first engineering experience was acquired in 1898 with the Illinois Central Railroad. Since then he has been engaged in railroad and general engineering and contracting in the Southwest.

R. G. Wyman was recently made division engineer of the Atchison, Topeka & Santa Fe Railway, with office at Amarillo, Tex.

Joseph Wright, for ten years in the employ of the U. S. Reclamation Service, has been made resident engineer on an extensive paper-mill and water-power project north of Vancouver, B. C. For nearly eleven years, beginning in 1895, he was with the War Department on river and harbor improvements in the Vicksburg district. For six years he had charge of construction in the Chicago district. While with the Reclamation Service he constructed the Corbett dam on the Shoshone project, ten miles of the Garland canal and the Ralston reservoir dam; on the Milk River project he built the Dodson dam with government forces. Mr. Wright also directed the construction of the Lower Yellowstone dam and on the Flathead project he prosecuted the driving of the Newell tunnel for a year and directed dam and canal work as well. The St. Mary's canal, including two long river pipe line crossings and a system of high drops, was also built under his direction. In 1906 Mr. Wright was with Hugh L. Cooper and made preliminary surveys and investigations for the Mississippi River power plant at Keokuk.

D. A. Blackburn has opened an office as consulting irrigation engineer at Brawley, Cal.

C. S. Butts, principal assistant engineer of the St. Louis Department of Public Utilities, has been appointed engineer in charge of the construction of the municipal dock at North Market Street.

A. B. Clark has resigned as deputy commissioner of the New York street cleaning department.

Thomas E. Jeffries, assistant U. S. engineer in charge of work in Kanawha County, W. Va., has resigned after about 35 years of service.

Raymond W. Parlin has been appointed deputy commissioner of the New York street cleaning department, to succeed A. B. Clark, resigned. Mr. Parlin studied civil engineering at the Massachusetts Institute of Technology from 1903 to 1908, alternating his student work with employment by the Massachusetts State Board of Health and private concerns interested in the disposal of manufacturing wastes. Mr. Parlin was also employed on the construction of the Pepperell (Mass.) waterworks. Practically all of his time has been devoted to sanitary engineering practice.

George F. Cotterill, state highway engineer and former mayor of Seattle, was the principal speaker at the luncheon of the Hoquiam (Wash.) Commercial Club, Nov. 22.

Rudolph Evers has resigned from the engineering department of the Interborough Rapid Transit Company to become structural engineer for G. D. Jenssen & Company, architects and engineers, of New York City. Mr. Evers had been with the Interborough since 1911, and at the time of his resignation was engaged on the three-tracking of its elevated lines.

Robert S. Beard has been made acting assistant city engineer of Kansas City, filling the vacancy left by Clark R. Mandigo, who resigned, as noted in this column recently, to go with the Portland Cement Association. Mr. Beard has been in the engineering department for several years, and also with the Kansas City Terminal Railway.

O. E. Eltinge, formerly assistant engineer to E. B. Murray & Company, consulting engineers, has been made chief draftsman of the sewer division of the Kansas City Engineering Department.

Obituary Notes

Harold Parker, former chairman of the Massachusetts Highway Commission and a native of Charlestown, died recently at his home in Lancaster, Mass., at the age of 62. He received his early education in Philadelphia and Lancaster and was a graduate of Phillips Exeter Academy. After attending Harvard University for two years Mr. Parker entered the employ of the Pennsylvania Steel Works. Later he established the civil engineering firm of Parker & Bateman, with offices in Clinton, Mass. In 1900 he was appointed to the Massachusetts Highway Commission, and after serving as a member for a few years succeeded W. E. McClintock as chief executive of the board. Upon his retirement from the commission in 1911 Mr. Parker became vice-president of the Hassam Paving Company, of Worcester, Mass., and also acquired an interest in the lumber industry. In 1913 and 1914 he was a member of the advisory board of the highway department of the state of New York. He was at one time president of the Massachusetts Highway Association and chairman of the Wachusett Mountain State Reservation Commission and of the Massachusetts Forest Commission. He had also been a member of the Massachusetts House of Representatives. Mr. Parker was a member of many organizations, including the American Society of Civil Engineers, Boston Society of Civil Engineers and Engineers' Club of Boston. He was in charge of the work of the Massachusetts Highway Association at a time when the building of roads capable of withstanding automobile traffic first assumed importance.

F. S. Bates, general sales manager of the Rensselaer Valve Manufacturing Company, died recently in Troy, N. Y., at the age of 50. Mr. Bates had been in the employ of the Rensselaer organization for twenty-three years.

W. W. Scranton, president of the Scranton Gas & Water Company, died Dec. 3 at his home in Scranton, Pa., at the age of 72. Mr. Scranton was graduated from Yale University in 1865. Later he devoted his energies to the Scranton Steel Company, which plant, it is believed, was the first to roll 120-ft. steel rails from the ingot. The Lackawanna Steel Company absorbed the Scranton concern in 1901, after which Mr. Scranton gave his time to the gas and water company, which now owns property valued at $15,000,000.